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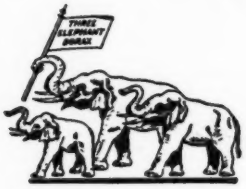

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXXI NO. 11

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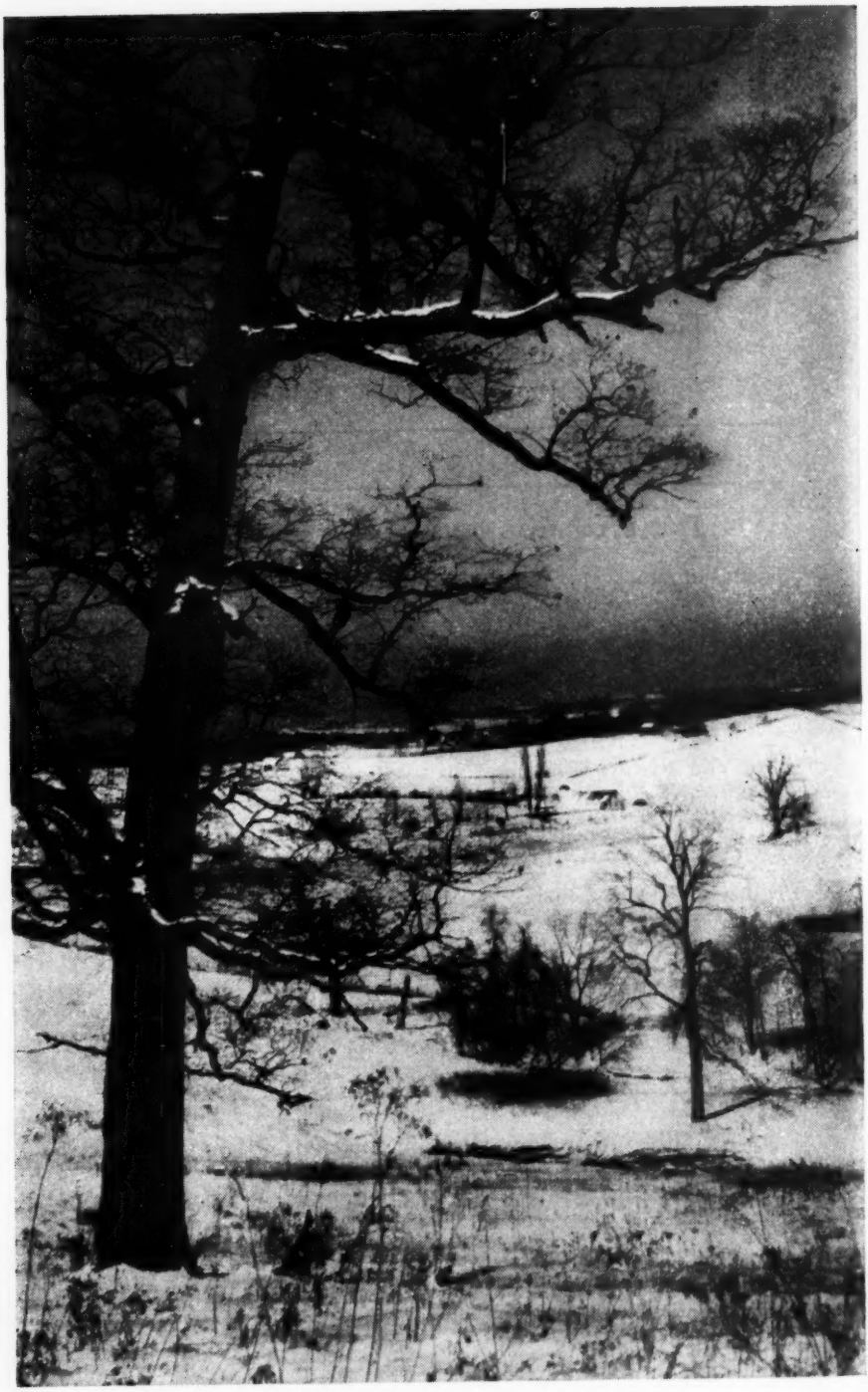

THE FIRST SNOWFALL

Better Crops with PLANT FOOD

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VOL. XXXI WASHINGTON, D. C., November 1947 No. 11

Confronting the . . .

Food Furore

Jeff McDermid

BEING ON THE FOOD "firing line" surely gives one a big appetite. You don't have to pitch manure or grain bundles to get it either.

There are at least two spots where public inquiry is focused respecting food supplies and prices in a constant and perplexing way, about which a few rambling observations may not be inadequate. The two red-hot information dispensing agencies that have borne the brunt of the avalanche of daily queries are the Office of Information's press and radio services in U. S. Department of Agriculture at Washington, D. C., and the respective regional field branches devoted day and night to the same round of endless conversation.

Right here some smart alec might flip the remark that what we need is less conversation and more conservation in food tonnages, but such a chap lacks information, not to say intelligence. If you stifled conversation, dear readers, you would hamstring the mainspring of facts and figures upon which so many rely to keep the w. k. campaign raging. How else do you presume the columnists and commentators get their low-downs on the high-ups? Or the morning daily its startling revelations to accompany the eggs on Tuesday and the bacon on Thursday?

Unfortunately, the word "information" sometimes gives the wrong clue when it is printed on an office door. It doesn't signify that behind its glazed surface there sits a wiseacre or a whole school of sages who can save you from investing in a world almanac or spending an hour in a Carnegie library. It's hard enough to satisfy requirements if the blank spaces to fill in are restricted to farms and farming, feeds and feed-

ing, eats and eating. But sad to say, that's never the way it works in an "Information" office. You are just as apt to have to reply to an ink spot remover query as to a question on removal of the spud surplus.

Many times while occupying an intensive place in a strategic center of the web of crosscurrents flowing around food affairs, yours truly has used other men's research as an anchor to windward. If someone had not lugged brief cases around and bent wearily over dry accounts and bills of lading for weeks on end, plenty of reporters, editorial writers, and radio commentators would have been shy of ammunition, or would have had to improvise more than customary.

Ordinarily it is an all-year-round open season for hunting for statistical researchers in Washington and elsewhere. Gunning for their goats is a national pastime when malefactors in other fields with more ulterior motives are not in sight. I hold no special brief for statisticians or their brief cases as such, ask no favors for them which are undeserved—but it does seem as though many of us might recognize at this juncture, when hot figures on food are so popular, that these studies have some current usefulness.

For example, in the heat of the h. c. of l. furore and the morbid curiosity about food of all kinds, including the contents of the garbage can and the rat's nest, we relied a lot on certain happy references we had in stock. These included a study on marketing margins in meats and another in grain products; an estimate of meat bills paid by consumers for several years in relation to net income; and a valuable piece giving details about waste and loss in food merchandising.

ON THE SIDE related to production, the feed saving drive found the country well fortified by years of basic data on rations and substitute cereals for corn and wheat—in fact, so well are we endowed with data that we believe the livestock world is better supplied with nutrition tables and formulas than human beings are.

If the Federal offices and files do not have material to support fundamental and funny queries, the State experiment stations often can unearth them. No matter how incongruous the query or how vapid the suggestion, the one who answers the phone or dictates the return letter must give it as much sober thought as though the life of the U.N. hung in the balance. The job of the public information desk in reality is to clear these things to inquiring reporters or curious cranks. The drawback to it is the physical lack of drawers and filing cabinets to keep your assorted answers in, as well as a shortage of manpower (and womanpower) to handle the load.

DURING THE WAR YEARS, farm journals were mainly the mediums which reported the 30 per cent or more increase in food production by a decreased farm working force equipped with machinery and fertilizers. Hardly any space was devoted to that in the daily newspapers, where more exciting and sensational war news was the rule.

About the only echoes of rural progress which newspapers retailed in 1941-44 related to the boost in farm incomes and those horrid arrangements which the hay-shakers had with Uncle Sam to loot the family lunch budget. It was not until folks had settled down into a race for comforts and luxuries after V-J Day that the readers of newspapers began to get anxious about the effect of price decontrol and cash competition upon the scope and variety of their victuals, and the price tags thereon.

Only a few stopped to inquire what effect the price incentive measures in agriculture had had on maintaining full gravy bowls during the lend-lease era, when outbound foods to armed forces and our allies accomplished what our mutual friend, Claude Wickard, called "winning the war and making the peace." They had "et up" all the provisions of yesterday and were hungry for more—the cheaper the better.

At this strategic point, I reach into the handy grab-bag and insert a digit clincher, like we use with stray newspaper men:

"In 1935 official figures show that disposable income per capita for the country was only $435. That year consumers spent $1,863,000,000 for beef, and steers grading choice and prime at Chicago made up 14 per cent of the total sold for slaughter.

"In 1945 disposable income was rated at $1,073 per capita. Consumers spent $3,026,000,000 for beef. Choice and prime steers sold at Chicago amounted to 36 per cent of the total there."

Mounting grocery bills and cuts of meat that were costly enough for jewelry window displays aroused the populace. Reactions toward most agricultural information quarters came immediately. You almost ruined your eyesight delving down long columns of published tables trying to locate the farmer's share of the retail customer's price and why.

Let us be Thankful

PRIOR TO THIS dizzy period, the nation embarked on its first campaign to get food, mostly grain, to starving Europe and Asia. We then possessed some vestiges of wartime controls on tap, so the wheels began grinding pronto and the officials started serving dark blue bread to reporters in Washington as a foretaste of what was to come. This was the signal for us to rap on the doors of the scientific bureau bakers and millers within our bailiwick. Reporters wanted all the dope there was, and then some, on the saving from a higher rate of wheat extraction and its effect on everything from milk toast to expectant mothers.

Similarly, and even more subsequently, Information toilers were besieged for data on distilling and brewing (which were then under curbs) to ascertain to what extent the cocktail hours of official circles might suffer sudden spiritual dilution or how much more one might expect to fork over for cereals in liquid form. The writing fraternity is usually presumed to have recourse to such stimulating beverages to a greater extent than, shall we say, the ministry. Hence they had a rather urgent and personal zest for following this line for a fill-in.

Every side current that swept the stream of activity during the postwar grain export period has called forth countless queries. Boxcar shortages, reports of wheat piled outdoors, stevedore strikes at the docks, black-market rumors, speeches in Congress and on the radio pro and con, and behavior of the future markets all have been turned wrong side out in a feverish search for stories.

Utilization of the cereals exported at ports of destination, method of distribution abroad, whether grain growers in Europe were selling their stocks or hoarding them for barter, and what some rabble-rousers were quoted as advising in a "fur off" land—all came tumbling back to land on our desks for possible official comment.

But the greatest crush of visits, phone calls, wires, and letters began to arrive last midsummer, when the Crop Reporting Board and its field associate corps assembled the estimates which presaged a much curtailed corn crop. This ushered in the biggest correspondence and publicity educational course

(*Turn to page* 51)

How Different Plant Nutrients Influence Plant Growth

By Lester L. Loftin

Shreveport, Louisiana

OF THE 92 elements of which the earth is composed, plants require for proper growth considerable amounts of only 10 major elements and minute amounts of a number of other elements. These elements are carbon, hydrogen, oxygen, and nitrogen, which come directly or indirectly from the air and water; and phosphorus, potassium, calcium, sulphur, magnesium, and iron, which come directly from the soil. Copper, zinc, boron, manganese, and perhaps others which come directly from the soil are required only in minute amounts but are important from the standpoint of plant growth or of the well-being of the animals that consume the plants.

Of the elements mentioned, nitrogen, phosphorus, and potassium are the most likely to become critically deficient and may be classified as fertilizer elements in the commercial sense.

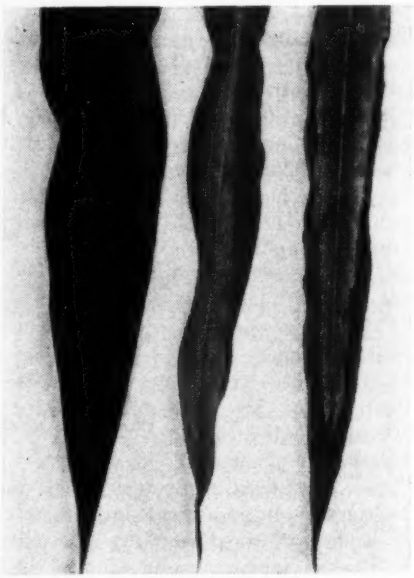

Fig. 1. Left, complete fertilizer; center, starved for nitrogen; right, starved for potash.

Nitrogen

Of the three elements, nitrogen, phosphorus, and potassium, that are usually applied in commercial fertilizers, nitrogen seems to have the quickest and most pronounced effect. It tends primarily to encourage aboveground vegetative growth and to impart to the leaves a deep green color. With cereals it increases the plumpness of the grains and their percentage of protein. With all plants nitrogen is a regulator in that it governs to a certain extent the utilization of potash, phosphoric acid, and other constituents. It also tends to produce succulence, a quality particularly desirable in certain crops such as lettuce and radishes.

Plants receiving insufficient nitrogen are stunted in growth and have a restricted and fibrous root system; the leaves turn yellow or yellowish-green and on some plants tend to drop off. The addition of a small amount of available nitrogen will, other conditions being favorable, cause a remarkable change, indicative of the activity of the element within the plant. Of the three common fertilizer constituents, nitrogen is the only one which, added in excess, will ordinarily result in harmful effects on the crop. Very dark green, soft, and sappy leaves are an indication of an oversupply of nitrogen. The possible and important detrimen-

tal effects of an excess of this element are as follows:

1—It may delay maturation by encouraging excessive vegetative growth which remains green beyond the normal period of ripening.

2—It may lower quality. The shipping qualities of certain fruits and vegetables are greatly impaired by this condition.

3—It may weaken the straw and cause lodging in grain. This is due to an extreme lengthening of the internodes, and as the heads fill the stems are no longer able to support the increased weight.

4—It may decrease resistance to disease. This is probably due to a change in the physiological conditions within the plant, and also to a thinning of the cell wall, allowing a more ready infection.

Many crops such as the grasses, lettuce, radishes, and the like depend on plenty of nitrogen for their best and most normal development. In fact, standard quality is not attained unless large amounts of nitrogen are available. With such crops, therefore, the detrimental effects that have been mentioned are not to be expected unless excessively large amounts of nitrogen are present. Nitrogenous fertilizers may be used freely with these crops. As a rule, one can be guided by the cost of the materials in relation to the value of the crops.

Phosphorus

No form of life could exist without phosphorus. Cell division and the formation of fat cannot go on to a sufficient extent without it. Starch may be produced when it is deficient, but does not readily change to sugar. Seeds do not form without its presence. Flowering and fruiting depend markedly on phosphorus. Phosphorus especially hastens the maturation of the crop and in this respect counteracts the effect of excessive nitrogen.

Phosphorus, also, encourages root development, particularly of the lateral and fibrous rootlets. The ratio of grain to straw, as well as the total yield, is increased in cereals by phosphorus. Phosphorus also strengthens the straw,

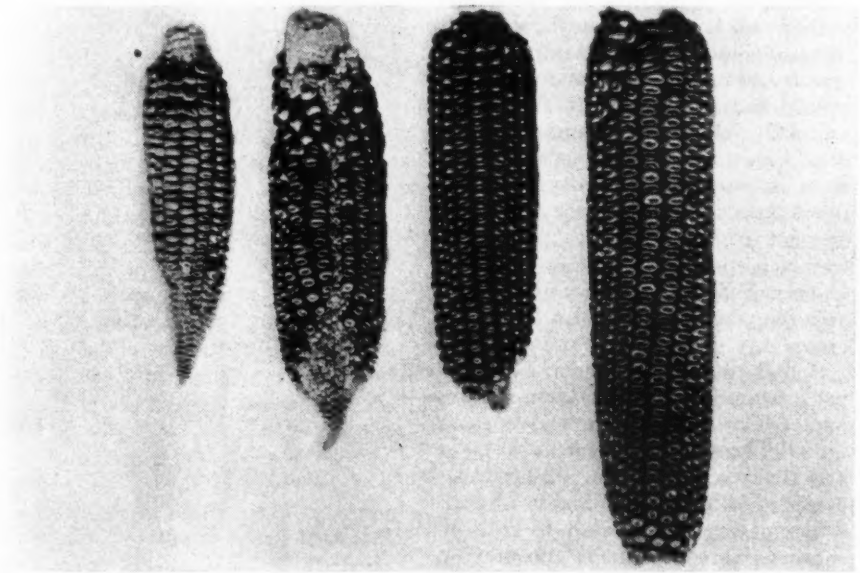

Fig. 2. Left to right: Starved for potash; starved for phosphorus; starved for nitrogen; a normal ear which was grown with a complete fertilizer.

thus decreasing the tendency to lodge. A lack of phosphorus results in a restricted root system and a bronzing or purpling of the leaves.

The palatability of vegetables is influenced to a great extent by phosphorus. Phosphorus is also known to increase the resistance of some plants to disease, due possibly to its effect in aiding a more normal cell development. Phosphorus tends to alleviate the detrimental effect of overliming, perhaps by restoring the phosphate nutrition that seems to be upset by the absorption of too much calcium.

Potassium

The presence of plenty of available potash in the soil has much to do with the general tone and vigor of the plant. By increasing resistance to certain diseases and encouraging the root system, potash tends to counteract the ill effects of too much nitrogen. In delaying maturity it also works against the undue ripening influence of phosphoric acid. In a general way, it exerts a balancing effect on both nitrogen and phosphorus.

Potassium is essential for starch formation and is necessary in the development of chlorophyll. It is important to cereals in grain formation, giving plump heavy kernels. It also seems especially valuable to leguminous crops of all kinds. Abundant available potassium is absolutely necessary for tuber development and consequently this element is almost always present in fertilizers used for potatoes. It may be present in large quantities in the soil and yet exert no harmful effect on crops.

A lack of potassium markedly impairs the capacity of a plant to assimilate carbon dioxide. The leaves die at the edges and appear blotchy in color and they do not contain their normal amounts of sugar and starch. The addition of available potash to the soil rectifies this condition by encouraging photosynthesis, the use of nitrate nitrogen in protein synthesis, the intake of water, and root development. The influence on starch production is especially noticeable with root crops, which markedly respond to potassium fertilization.

So far as is now known, potassium does not build into the structure of any of the plant's parts. A plant will hold its potassium salts from being washed or leached out as long as it is living but as soon as the plant is killed by cutting, the potassium, no longer held, will be washed out readily—as, for example, by rain on dried hay or cornstalks. Some potassium salts will also move from the plant back into the soil as the plant matures. Not much is known about the function of potassium in plants. More is known about what happens to a plant when this element is deficient.

In considering the respective effects on plant growth exerted by the three principal fertilizer elements, it is noticed that they tend to check, balance, and support one another.

Calcium

The carbon dioxide in the soil solution makes it a potent solvent for cal-

Fig. 3. Potash deficiency is indicated by white spots on alfalfa and clover. Later the edges of the leaves become dry and appear scorched.

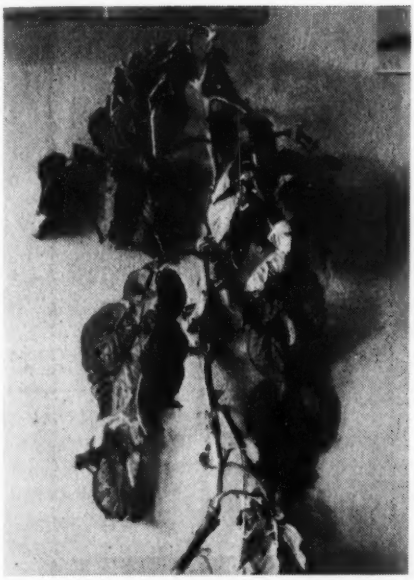

Fig. 4. Chlorosis on potatoes due to lack of magnesium. The lower leaves of magnesium-deficient plants are brittle, which serves to distinguish them from leaves yellowing naturally through age.

cium compounds; thus calcium is leached out of the soil as calcium bicarbonate. The soil acidity is increased by this process. In plants, calcium is built into the walls of the cells to form a protective "sieve" for the nutrients to seep through in passing into the cells. It also acts as a cement between the walls of the cells to hold them together. As the cell processes go on to develop the complex substances in the plant, some organic acids are formed that would be harmful were it not for the neutralizing effect of calcium.

When calcium is added to the soil it is usually applied in the form of limestone. Lime is not, strictly speaking, a fertilizer but a soil amendment applied to correct acidity and improve other conditions of the soil; however, one of its functions is to supply calcium if the soil is deficient in this element.

Acid soils have many factors that are unfavorable for the proper growth of plants. The activity of many beneficial soil micro-organisms is greatly retarded by acids found in the soil. This condition affects the availability of nitrogen and other elements. Many species of the nitrogen-fixing micro-organisms are especially sensitive to acidity and can exist for only comparatively short periods in distinctly acid soils. High acidity may bring about toxic concentration of iron and aluminum salts. Certain fungus diseases develop to a harmful extent only in acid soils.

Lime applied to acid soils benefits them in many ways. It neutralizes acids in the soil and stimulates the proper decomposition of organic matter, improves the physical condition of heavy soils, supplies calcium, and promotes bacterial activity in the soil. It makes other elements available to growing plants and generally increases the efficiency of manures and fertilizers. Lime added to acid soils decreases the amount of toxic agents in the soil and in some cases reduces the susceptibility of plants to certain diseases.

Sulphur

Plants frequently contain more sulphur than phosphorus, calcium, or magnesium. Since sufficient amounts of sulphur are usually present in the soil we are not so well acquainted with it. Rain returns to the earth as much as 10 pounds or more of sulphur per acre annually. When phosphorus is applied in the form of superphosphate and acid-treated bone, sulphur is an accompanying element. In superphosphate, the sulphates commonly exceed the phosphates.

Plants that have insufficient sulphur show characteristic symptoms that may resemble those of nitrogen starvation. When sulphur is applied in any great amount, it is for reasons other than its direct nutritional effect. An example of this is the use of sulphur to increase soil acidity in the control of potato scab or in the growing of such acid-loving plants as Azaleas and Rhododendrons.

Magnesium

Magnesium is credited with being a

(*Turn to page* 49)

The influence of various amounts of fertilizers on yield of sweet potatoes. Left to right—(1) 45 lbs. of nitrogen, 45 lbs. phosphoric acid, and 60 lbs. potash. (2) 60 lbs. of nitrogen, 90 lbs. phosphoric acid, and 120 lbs. potash. (3) 75 lbs. of nitrogen, 135 lbs. phosphoric acid, and 180 lbs. potash.

Fertilizer Practice For The Ranger Sweet Potato

By Jackson B. Hester

Campbell Soup Company, Riverton, New Jersey

OWING TO THE HIGH yielding quality, deep orange color, and pleasing taste of the Ranger variety of sweet potatoes, plus its adaptability for certain commercial uses, as well as the regular market, there has developed an interest in the most desirable fertilization practices. This variety was first developed by J. C. Miller and was introduced into New Jersey by D. R. Porter. During 1943 and 1944, in the hands of nine different growers under similar conditions, the Ranger produced 47 per cent more potatoes than the Yellow Jersey variety. Since the interest in the variety has increased, it has become necessary to learn as much as possible about its fertilizer requirements.

Growers' Fertilization Practices and Yields

A survey of a number of growers' fertilization practices reveals that different quantities and methods of fertilization have been used. The summary of this survey is shown in Table 1. The amount of fertilizer that gave the largest yield was 45 pounds of nitrogen, 135 pounds of phosphoric acid, and 180 pounds of potash. The method of fertilization obviously was important and the use of part of this fertilizer before planting and the remainder by side-dressing seemed to give the best yield. This is largely due to the sandy nature of the soil. A number of good farming practices are necessary to get the maximum advantage of the fertilizer used and these data reveal that some growers used the necessary amount of fertilizer, but did not produce the crop, due to some other limiting factor. In this connection, some experimental results obtained in 1946 are interesting.

Experimental Findings

A fertilizer experiment was laid out on a Sassafras sand near Cinnaminson,

New Jersey, for the purpose of obtaining information about the amount of fertilizer and method of application. The soil is typical of those used in New Jersey for sweet potato production. The organic matter content is approximately one per cent, the pH value 5.0, and the available nutrient low, with the exception of phosphorus. The phosphorus content of most of these soils has been built up to a rather high level during the past years, although most of it is tied up by the soluble aluminum and iron that occurs in the soil at such low pH values.

Before the sweet potatoes were transplanted to the field, 500 pounds of a 3-9-12 fertilizer mixture per acre were broadcast on the land. This mixture contained five pounds of borax to the ton. The fertilizer was disked into the soil and the plants set with five pounds of 8-24-8 starter mixture per 50 gallons of water. The remaining fertilizer treatments were (1) none, (2) one and two side-dressings of 500 pounds each of 3-9-12 on one series of plots, and (3) one and two side-dressings of 250 pounds of muriate of potash on another series. Following the heavy rains in early June, approximately 100 pounds of ammonium nitrate per acre to supply additional nitrogen were broadcast on the whole area. The maximum yield was obtained with 75 pounds of nitrogen, 135 pounds of phosphoric acid, and 180 pounds of potash.

It is observed that four of the grower's yields were superior to this. They used the same amount of phosphorus and potash, but less nitrogen. Magnesium deficiency developed in the experimental plots after the heavy rainfall in June, and an attempt was made to correct it by spreading 200 pounds of magnesium sulfate per acre down the rows on July 22. While no further symptoms developed, the original breakdown in the leaves was not corrected. This undoubtedly cut the yields somewhat. More magnesium deficiency developed on the plots receiving 360 pounds of potash than on those receiving the lower amounts of potash. Table

TABLE 1

GROWERS' FERTILIZATION PRACTICES AND YIELDS FOR THE RANGER SWEET POTATO

Grower	Fertilizer Used Pounds per Acre			Method of Application	Total Yield Lbs./A.
	N	P_2O_5	K_2O		
A	45	135	180	Row and side-dressed	21,550
B*	45	135	180	2/3 plowed down, 1/3 side-dressed	20,085
C	55	140	170	Row and side-dressed	18,370
D	30	120	180	Broadcast and side-dressed	17,700
E	30	90	120	Two side-dressings	15,490
F	60	180	240	Broadcast	13,550
G	70	140	140	Row and side-dressed	13,020
H	42	126	168	Row and side-dressed	12,950
I	48	144	192	Broadcast and side-dressed	11,800
J	30	90	120	Row	10,030
K	45	135	180	Row and side-dressed	8,130
L	60	180	240	1/2 plowed down, 1/2 side-dressed	8,000
M	60	180	120	Row and side-dressed	6,490
N	42	126	168	Broadcast	6,050
O	60	180	240	Broadcast	2,960
P	9	27	36	Row	2,420

* 5 or 6 tons of chicken manure.

2 and Figure 1 give the yields from these treatments. Because of the magnesium deficiency and the influence of potash fertilization upon it, a series of experiments in 1947 were planned.

TABLE 2

EXPERIMENTAL FERTILIZATION PROGRAM

Relative Order	Fertilizer Used Pounds per acre			Total Yield Lbs./A.
	N	P_2O_5	K_2O	
1.....	75	135	180	17,342
2.....	45	45	210	15,783
3.....	60	90	120	14,728
4.....	45	45	360	14,112
5.....	45	45	60	11,625

Six replications. Differences highly significant. Credit is given G. E. Smith and P. P. Nixon for assistance in obtaining these records.

Magnesium Deficiency

Magnesium deficiency symptoms on the Ranger sweet potato are different from those on the other varieties grown in New Jersey. For example, where the interveinal yellowing develops on the other varieties in New Jersey, the Ranger variety shows a purplish red color similar to the cotton plant. Furthermore, this purpling is transferred to the root, making the potato objectionable looking when cut. Since many of the commercial fields showed magnesium deficiency, it is believed that magnesium nutrition is important. In other words, the soil should be well supplied with magnesium or some should be used in the fertilizer because most sweet potato soils are not limed as a regular practice.

In 1947 a Sassafras (Toghwogh, Indian name) sandy loam which had a poor soil test for magnesium and on which sweet corn growing in 1946 showed magnesium deficiency was selected for the investigation. Seven different fertilizer mixtures were made, namely (1) 3-9-6 (N-P-K), (2) 3-9-12, (3) 3-9-18, (4 and 5) 3-9-12 with 2% and 4% MgO from magnesium sulfate, and (6 and 7) 3-9-12 with 2% and 4% MgO from dolomitic limestone. Amounts of calcium limestone equivalent in neutralizing value to the dolomitic limestone were added to the mixtures that did not have magnesium sulfate. Five pounds of borax per ton were added to each mixture. The potash was derived from 60% muriate of potash, the phosphate from 20% superphosphate, and the nitrogen from sulfate of ammonia and cyanamid. The fertilizer was added at the rate of 1,600 pounds per acre, 800 pounds in the row previous to planting and 800 pounds by late side-dressing. The plots were 1/80 acre in size with the two center rows (3 ft. x 18 in.) being harvested. All plots were replicated five times and subjected to statistical analyses.

The data given in Table 3 show that there was no significant difference in the yields of 6, 12, and 18 per cent potash in the mixtures where magnesium was left out; whereas, increased yields were obtained with the addition of magnesium to the fertilizer mixture. The addition of 4% MgO from dolomitic limestone gave a highly significant increase in yield at the one per cent level. The potatoes produced on the plots having magnesium added were free of the purple color in the potato and were smoother in appearance where the deficiency was corrected.

Because of the widespread magnesium deficiency in the sweet potatoes grown on Coastal Plain soils and for better utilization of the potash added, it is recommended that sweet potato fertilizers carry available magnesium. Some growers are using less potash in their mixtures because of the severe magnesium deficiency. This is not a solution to the problem, for the growers are sacrificing yield and quality.

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Fig. 1. Contented cows on good pasture help insure profit from dairying.

Are You Pasture Conscious?

By S. D. Gray

Washington, D. C.

SUCCESSFUL FEEDING of livestock, whether beef or dairy, depends to a large extent upon the relative availability of suitable pastures. Barn feeding is always expensive. Under average conditions it costs from three to four times as much per day to feed a mature animal in the barn or feed-lot as on pasture. Where pasture is the principal asset as in the range country and where grain or other concentrates are limited in supply as in the Northeastern States, the practices employed will, or should be, based on maximum use of pasture.

Through the tragic sequence of ignorance and mismanagement our farm economy at various times has suffered, due to overproduction of certain farm crops. Crop farmers instinctively dislike any talk of balanced production. For years they have been urged by Federal and State agricultural authorities, as well as the fertilizer industry, to reduce the acreage of these crops and to give more attention to pastures. Despite these efforts, little real progress was made until the great agricultural depression of the early "Thirties." Federal subsidies under the Soil Conservation and Agricultural Adjustment Acts provided an incentive, and national emphasis on balanced production gave to pastures the prominence they deserved.

Pasture improvement programs today are making remarkable progress in many states. Vast numbers of farmers who early recognized the logic of wider use of pasture at the expense of cultivated crops, and got on the "band wagon," have a deep appreciation of

its importance for prevention of soil erosion as well as the inevitable benefits of diversification—balanced production, better utilization of land and labor, better livestock feed, and increased net returns from farming operations.

Livestock farming, one of the most important and profitable types of farming in the Northeastern States, has been greatly influenced by pastures. Valuable as they have been as a chief source of feed, their full importance as an agricultural resource has never been fully developed. Their economic utilization is still the most important problem in the stabilization of the post-war agricultural program in this region.

While pastures have contributed greatly to the success of livestock farming by supplying a cheap and highly nutritious feed, it must be remembered that this in far too many instances has been largely at the expense of the fertility of the soil. Continuous removal of the mineral plant-food elements, lime, phosphorus, magnesium, and potash, in livestock products sold off the farm, without replacement through fertilization, has reduced yields and increased cost for barn feeding to a point which seriously threatens economic production on many farms. Fertilization of good pasture to keep it good, or of below average pasture to restore it to a satisfactory level of production, is not only a wise investment but a realistic challenge to every business-minded livestock farmer.

In planning for pastures on the average livestock farm a number of things must be considered. The principal object, of course, is to provide feed in quantity as well as quality for the animals to be fed. There is also the consideration of the threat to civilization from soil erosion and the need of a protective covering of pasture herbage to heal the scars of wind and water and to hold the surface soil and fertility that remain. In these major objectives, simple fundamentals are involved. In the words of Dr. W. A. Albrecht of Missouri they are summed up in this concise statement: "Sick soils will not produce healthy plants; sick plants will not nourish healthy animals; and sick animals will not yield a satisfactory income."

Mining soils of their fertility too frequently has resulted from farming operations. Again quoting Albrecht,

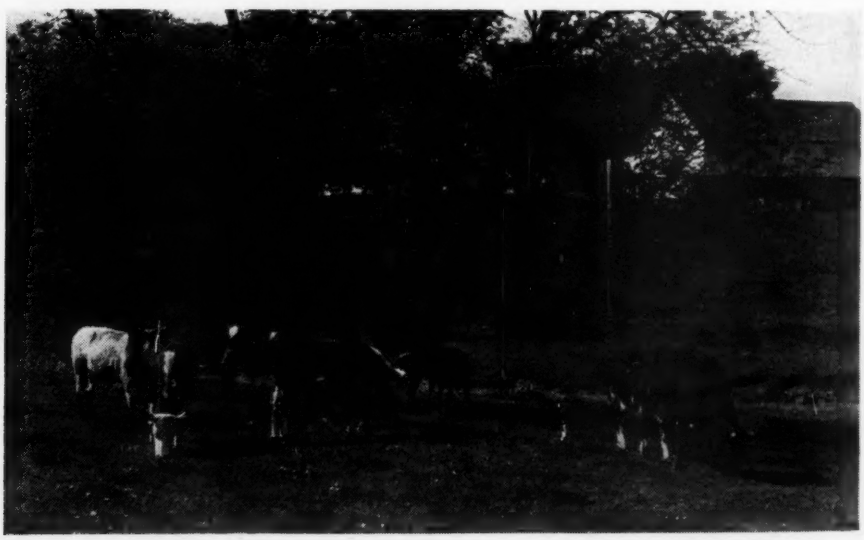

Fig. 2. Young steers make good use of fertilized pasture.

Fig. 3. This Skowhegan, Maine, pasture received 600 lbs. of 5-8-7 fertilizer and returned a net profit of $36 per acre.

"It has brought us face to face with the simple fact that our plant factories are not running as efficiently for feed production as they once did when our soils contained more of their virgin fertility. Our farm meat and milk factories consequently also are operating on less efficient levels. Notwithstanding our knowledge of better nutrition and ability through diagnosis of animal ailments to determine the causes, the solution in the final analysis must come from supplying the animals more nearly normal nutrition by way of normal feeds grown on fertile soils."

In the economy of Nature, one of the highly important tasks assigned to plants is that of collecting mineral elements from the soil and processing them for the use of animals. The final product, therefore, is good or bad in proportion to the abundance or lack of the essential minerals supplied by the soil. Under range conditions, animals roaming freely have considerable capacity for balancing their own rations. Confined to a specific field or farm, however, where their feed may be deficient in certain minerals, abnormalities in growth and reproduction are likely to result.

When chemical analyses of soils or herbage are related to specific animal abnormalities, they invariably designate the seat of the trouble as the low level in the soil of the nutrients essential for plants and required in larger amounts by animals. Mineral deficiencies in plants and in the diet of animals that feed on them are most likely to occur in the marginal soils of humid regions, where the virgin fertility has been exhausted or where the system of farming has not permitted the economic use of lime and the ordinary mineral fertilizers. Such soils are widely distributed in the older agricultural sections of the Northeastern States.

The carrying capacity of many pasture lands is ridiculously low. A study of the statistics on this subject reveals that on the arid and semi-arid ranges from 25 to 100 acres of land are required to support one full-grown cow or steer. In the humid regions where moisture is not a factor and where the soil fertility is still such as to support a fair growth of herbage, about five acres are required to support one animal unit. An examination of records on carrying capacity of pastures in important Euro-

pean countries shows that the number of acres required to carry one animal unit ranges from .91 in Belgium to 2.65 in Great Britain and Ireland. Corresponding figures from Germany, Denmark, and the Netherlands are 1.24, 1.46, and 1.60 respectively.

Pastures in the humid regions of the United States have gone through several distinct stages of impoverishment, each followed by lower production of forage of inferior quality. Depletion of the supply of lime and phosphorus is usually the first stage encountered and is reflected in a less vigorous growth of the grasses and legumes. This is followed by the exhaustion of potash, disappearance of legumes, and the appearance of inferior species of grasses, weeds, moss, and finally brush. In the first stages of soil fertility exhaustion, the use of phosphorus alone or with lime is likely to be sufficient to bring back the clover and through its growth help maintain the nitrogen supply. Most of the permanent pastures in the humid areas probably passed the first stage of fertility exhaustion more than a generation ago. They are now, therefore, about equally deficient with respect to potash, organic matter, and nitrogen.

Results of fertilizer experiments on pastures have been, on the whole, impressive and clear cut. Quite generally they have emphasized the importance of liberal fertilization. While authorities are agreed that phosphoric acid is almost universally deficient and consequently the basis of any successful treatment, repeated tests have shown that it is not always a sufficient treatment. Evidence is accumulating from experimental work in widely separated areas showing that potash is frequently as necessary as phosphoric acid, particularly in areas where emphasis is placed on the need for legumes in the pasture. These data also have stressed the relationships of lime to efficient utilization of phosphorus and potash. While the recommendations of the different experiment stations vary with respect to the fertilization of pastures, they are, generally speaking, in very close agreement on the matter of major objectives and practical management practices.

Pastures are recognized as being the best and cheapest source of protein feed. In the young, tender stage pasture grasses contain more protein than alfalfa hay and about twice as much as mixed clover hay. Cost of this protein is about one-third as much as in purchased feed. It is quite clear from the experimental work officially reported that both the yield of dry matter and the protein are greatly increased by proper fertilization.

Fig. 4. Fertilized pasture insures both early and late grazing and reduces cost for manger feeding.

Apart from bulk, the feeding value of pastures varies in different areas. It has been shown in recent investigations, reported by Dr. J. B. Orr of Aberdeen in his book "Minerals in Pastures," that one of the most important factors in determining the feeding value is the amount of calcium, phosphorus, sodium, potassium, and chlorine present in the herbage. Some pastures may be so poor in one or the other of these elements as to be the cause of disease among

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At the Tip of the Shoot And the Point of the Root[1]

By George D. Scarseth

American Farm Research Association, Lafayette, Indiana

YOUR PROGRAM COMMITTEE has reflected the wideness of your interest and their own adventuresome spirit in extending to me an invitation to address you. I am not an apple authority and have never been called a horticulturist, but have been branded variously as a soil scientist, agronomist, chemist, plant physiologist, banana specialist, photographer, and fisherman.

Well then, since we have unfurled our banners in their true light there can be no misunderstanding. I will rely on your own common sense and understanding of the practical angles of your apple-producing business to select and modify what I say in such a way as might best suit your individual particular case.

About three weeks ago I had the pleasure of attending an apple field day, or should I say orchard day, with the Horticultural Society of a neighboring state. At this session I heard a great deal about insects, pests, rots, dusts, and sprays, and absolutely nothing that dealt with such fascinating, and I think, important aspects as light, temperature, sugar production, foliage, woody growth, fertilizers, cultivation, moisture, root growth, and last but not least, what it takes for a tree to make a big crop of apples.

If I knew the answer to all the 64-dollar questions that relate to "what it takes to make an apple tree produce big efficient crops," I would be in the fruit business and sitting in the audience with you listening to Doctor Tukey and these other specialists giving me bits of facts for me to work out the profitable answers myself. Since I am only another specialist, I will limit myself to some of my own special facts and conclusions.

A Tree Has Work to Do

Let us consider an apple tree that has reached fruit-bearing age. In the spring of the year the tree must put out a whole crop of new leaves and blossoms. All the material to make this new growth must come from within the whole plant system—that is, the stuff to make this first new growth must be in the plant at the end of the winter. The sugars, amino acids (proteins), and mineral nutrients to make this material must be in the plant before the awakening period in the spring. We cannot assume that these growth materials come from an early spring treatment of the soils, such as from an early nitrogen application. We know that the sugars for the carbohydrates and woody parts of the new growth were made in the leaves the previous season. So it is most vital that the fall leaf crop was adequate to make enough sugar for the fruit crop as well as to store a goodly supply in the tree roots.

With a rich winter store of sugars to make carbohydrates and cellulose that are needed for new leaves, and a good supply of nitrates to make amino acids and proteins for the cells, plus the mineral nutrients that are needed, the tree is compelled to push out a big leaf growth as soon as the air warms up in the spring.

The new crop of fruit will be greatly affected by this leaf crop, because the

[1] Address before the International Apple Association, Detroit, Michigan, August 11, 1947.

leaves are the "work benches" in this apple factory.

We want this tree factory to work in making apples, and not be just busy making a lot of new woody growth. Of course, we could starve the tree so much that it could not make the necessary new growth that is needed. On the other hand, we could so overfeed or wrongly feed the tree that it has no other course to follow than to make just more growth and new foliage all summer long when it should be making apples and stuffing them with sugar. Let us consider this ticklish angle further.

When to Apply Nitrogen

Suppose a tree goes through the winter with its system rather starved for sugars and nitrates. When the spring warmth comes the pressure from the internal stuff will not be great and we can expect a poor development of leaves.

Now, suppose we give the tree a heavy spring nitrate fertilization with a soluble nitrate fertilizer and observe what happens. We see that such a tree responds rapidly in that the leaves turn deep dark green. A lot of new growth develops. Long, woody growth results, even a lot of water sprouts may develop. On this new growth new leaves are formed—the tree looks good to the eye. Is it making a lot of fruit? You know the answer is "no." This new growth of wood and leaves draws so heavily upon the sugars the older leaves are making that there seems to be none for the fruit. It is almost as if the tree felt that things were so rosy with plenty of food that "why worry about protecting myself by reproducing my kind with seed (new fruit)."

If there were a lot of organic matter in the soil or even a high nitrogen-containing mulch on the ground, we know that the tree would not get much of the available nitrates early in the spring. None of the organic nitrogen in vegetable matter or humus becomes available in the soil in the spring until the soil becomes warm. It does become available with warm weather and is then dynamically supplied, a little at a time, all the growing season. This is one of the great virtues of getting nitrogen to plants through humus—it is never too big a shot at one time with none present at other times.

So what is the conclusion from this type of reasoning? It adds up to an argument for applying the nitrogen fertilizers in the fall so that the tree roots can be absorbing them all winter out of the ground. How early or late in the fall? Late enough not to start a lot of new growth and early enough for ammonia nitrogen as in ammonium nitrate to be nitrified to nitrates. This process takes a few days of warm weather.

After such a bold statement without support of experimental evidence except scientific deductions, I should grab my bags and rush from town—never to mislead an apple producer again. I personally am a worshipper of fundamental facts. The fundamental facts are usually colorless by themselves, and the scientists that grub them out are usually the greatest underpaid and unappreciated servants in our past or modern times, but I have followed the procedure of fitting facts together to arrive at a practical answer so many times with profit to myself and employer that it is far better than merely guessing. The proof is needed but since the show goes on daily, the deductions made on fundamental facts are better than taking no action, because there might be no experimental proof. This tribute to fundamental facts and the unsung scientists that produce them is appropriate, because they are more valuable than the experiments to prove their practicability. On this of course, I could draw argument, but we digress from our story.

Let's Not Forget What a Mulch Does

The only place we could find fishworms during the hot, dry period of

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Fig. 1. Agricultural workers of Northeast Mississippi studying oats and rye grass for hog grazing on the J. C. Hardin farm November 1, 1946, in Pontotoc County. Cost of labor, machinery, fertilizers, minerals, and seeds was $47.45 per acre. Grazing at five cents per head per day totalled $490.50.

Fall and Winter Grazing In Mississippi

By Q. S. Vail

County Agent, Pontotoc, Mississippi

IN APRIL of 1946, after making the spring tour at State College, Mississippi and Noxubee County, as arranged by the State College Extension Service, Experiment Station, and Noxubee County Agent, and after discussing with the Pontotoc County Assistant Agent the need and best way of getting more fall and winter grazing in Pontotoc County, we decided to carry a group of Pontotoc County farmers, businessmen, and agricultural workers to Noxubee County for a short tour of several grazing projects.

Due to the limited number that could be handled in Noxubee for lunch, and in order to get a selection of farmers and interested businessmen who would do something about the grazing after they got back home, we limited the number to be invited. In order to get the influence and help of other agencies, the Assistant Agent and I personally visited each County agency, including two banks, dairy plant, Soil Conservation Service, Farm Home Administration, and Agricultural Adjustment Agency. We sold them on the tour and let them select their 10 men, and our office selected another 10. We wrote the five vocational teachers asking them to invite about 10 farmers.

Fig. 2. Improved dallis grass and white clover pasture. Fertilizer used was one ton basic slag and 200 lbs. muriate of potash.

Forty-seven showed up out of approximately 60 invited, and we hit the rain and mud to see grazing crops of oats, crimson clover, wild winter peas, dallis grass, white Dutch clover, and combinations being grazed by beef and dairy cattle.

Approximately 35 of this number listed their names with me later, after they had studied over the program, as wanting to start grazing projects on their farms. All were given cartons to collect soil samples from selected plots and samples were forwarded to State College Experiment Station Soils Laboratory for 15 of the cooperators. The necessary lime and phosphate or basic slag and potash were given on each analysis.

W. R. Thompson, Extension Pasture Specialist, talked to this 35 in a called meeting in May and stressed plans, minerals, preparation, and management. Seed and fertilizer dealers were informed as to materials needed and assistance was given them in securing these materials. Farm visits were made during July and August to assist the cooperators in planning. Farm visits were made again in September with W. R. Thompson to all 30 who carried on through with their planning. Seeding began August 31 and continued into October.

Recommendations of following soil analysis tests, applying minerals before breaking, applying 32 pounds nitrogen at time of seeding, seeding 3 bushels of oats, 20 pounds crimson clover, 20 pounds rye grass, 40 pounds wild winter peas, 5 pounds white Dutch clover, 15 pounds dallis grass, 25 pounds lespedeza, and 30 pounds sudan were made. Oats, rye grass, and crimson clover in combination were recommended as mixture to give most fall and winter grazing per acre, with oats and crimson clover next, oats and wild winter peas third, and rye grass and crimson clover or rye grass and wild winter peas last. Oats and wild winter peas were recommended drilled or cut in, rye grass seeded on top and harrowed in, and crimson clover seeded on top and cultipacked, if possible. Grazing was recommended to begin with oats when 8 to 10 inches high and control grazing until well established. Minerals and nitrates were scarce materials and were used as obtained.

The average cost ran about $25 an acre where recommended seeding and

soil analysis reports were carried out and was divided as follows:

		PMA
3 bu. oats @ $2.00	$6.00	
20# crimson clover @ 22¢	4.40	2.40
20# rye grass @ 11¢	2.20	
1,000# basic slag @ $15 per ton	7.50	3.50
or		
500# of 20% phosphate @ $24 and	(6.00	
2½ tons lime @ $4.37 delivered & spread	10.93)	
100# potash	2.50	1.50
Labor and machinery	10.00	
	$32.60	$7.40
Less PMA payment of approximately	7.40	
Total Cost	$25.20	

An agricultural workers' tour was agreed on for November 1, 1946 by J. E. Stanley, District Extension Agent, and W. R. Thompson, Extension Pasture Specialist, who also assisted a committee of Pontotoc County agricultural workers and several other district and State men in selecting 10 farms for the tour. One hundred fifteen attended and voted unanimously to return in the spring to see the same plots after they had gone through the winter. Eight community tours and one round-up county tour were held during the first part of November, with a total of 267 attending. Information sheets giving details of minerals, preparation, and seeding of each plot were given to each attending these tours.

Farm visits to all 30 farms were made in February of 1947 with W. R. Thompson, and suggestions offered on seeding lespedeza, top-dressing, and when to quit grazing plots on which seeds and small grains were to be saved. One night meeting was held, with Thompson leading the discussion and showing colored slides of grazing and pasture plots.

Farm visits were made during the first part of April of this year to the 10 farms toured the preceding November 1 in preparation for the April 11 agricultural workers' tour. Due to heavy rains over the district, only 60 showed up. Two stops had to be eliminated on account of roads. The county farmers' tour was set for May 9, with seven of these farms visited and 350 attending. Fifteen counties were

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Fig. 3. W. P. Gluhan, Pontotoc County, shown with registered Duroc Jersey hogs grazing oats, crimson clover, and rye grass. Acreage was increased from 17 acres in 1946 to 75 acres this year.

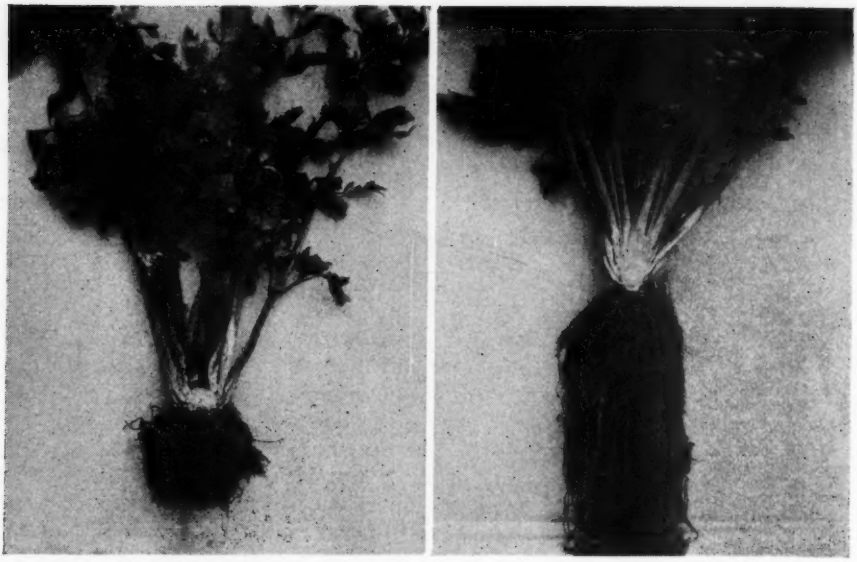

Fig. 1. These celery plants were well developed and equally vigorous when they were transplanted into the same kind of high boron-fixing soil. Without boron (left) the new growth or heart died and turned black. The roots were stubby, brown, and knotty. With boron (right) the heart was clear white and roots were vigorous.

Boron For Vermont Farms

By Kathleen B. Webb

Extension Service, Burlington, Vermont

IN World War I, boron in fertilizers proved to be a villain. Today, however, scientists are proving this villain is really a hero—if properly used. In recent years no single plant nutrient has received as much attention as boron. At least thirty-one states in the United States and six provinces in Canada have reported boron deficiencies in more than forty different crops. Although boron is a minor element in that only small quantities are needed, it is "major" in its essential role in normal plant nutrition.

In a report just published as Vermont Agricultural Experiment Station Bulletin 539, "Boron for Vermont Soils and Crops," agronomists A. R. Midgley and D. E. Dunklee describe their experiments with boron. The object of their work was to study the boron-deficiency symptoms of plants and to learn how boron should be used on Vermont soils. Their work was financed in part by a grant made by the American Potash Institute.

Chemical studies made on thirty-nine different soil types showed that only 22, or 56 per cent, had sufficient boron for most Vermont crops. However, even on these soils, extra boron is needed for high boron-requiring plants like alfalfa, many garden crops, and apple trees, Midgley and Dunklee point out in their report.

To study the boron deficiency symptoms they grew various crops in a special soil that contained no boron but was well supplied with the other plant nutrients. They obtained truckload lots of a highly leached A horizon of a podsol soil. After liming this soil, a generous amount of a complete fertilizer, together with magnesium and manganese, was added so that a lack of these would not limit plant growth. This soil was used with and without borax in greenhouse pots as well as in large metal tanks outside.

By placing plants at different stages of growth in this boron-deficient soil, a great variety of symptoms was produced on each plant. Midgley and Dunklee explain that this is because boron, unlike many other nutrients, cannot be reused by plants. A continual supply seems necessary for normal growth because, without adequate boron, growing points are usually affected first. "Dieback" or death of terminal buds and stems in the case of apple trees, "yellow top" of alfalfa in which the new growth turns yellow, and heart rot of celery where the growing tips die and are later invaded by organisms—all these symptoms were produced when the plants were starved for boron.

Fig. 3. When this one-year-old carrot root was transplanted into a very boron-deficient soil, there was typical dieback of the growing points and the nodes swelled.

Fig. 2. Cracks and external cork formed on these apples when drought or insufficient water early in the year shut off the supply of boron. They are known as drought spots.

When plants were given a new supply of boron after the growing points had died from boron starvation, additional shoots appeared, causing a multiple branching or witches' broom effect. With some plants a rosette appeared, due to an excessive number of leaves with shortened internodes. Defective flowers and a stripping of seed heads resulted in poor fruit or seed formation. Cankers appeared on stalks or stems of plants as well as on roots and storage organs. Splitting and cracking of fruit and stems seemed to be due to insufficient elasticity of cell membranes caused by lack of boron. Stalks, joints, and leaves swelled to abnormal size, ap-

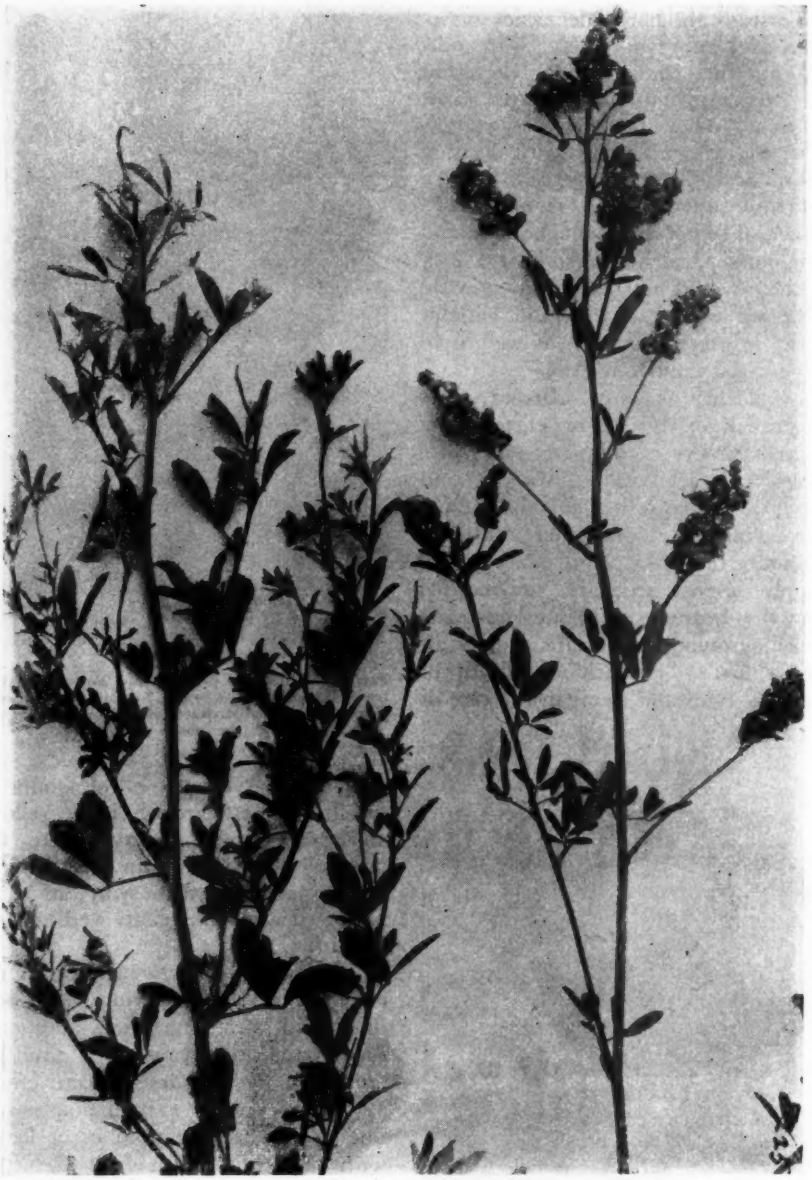

Fig. 4. Alfalfa plant without boron (left) lost all of its flowers and seed heads. Plant with commercial borax (right) produced a good crop of seed.

parently the result of an accumulation of carbohydrates that could not be properly moved through the plant without boron. Even roots produced knots or knobs and turned brown and died. Naturally these symptoms were not all obtained on all crop plants, but they occurred more or less on most plants that were starved for boron at different stages of growth, Midgley and Dunklee found.

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Some Things To Think About

By Firman E. Bear

Department of Soils, Rutgers University, New Brunswick, New Jersey

ON A VERY HOT DAY in July 1936, I drove across western Missouri on my way to Oklahoma to study the fertilizer-consuming possibilities of that State. The extremely dry weather that had prevailed generally over the United States for several years previously had reached its climax. Most of the grass and corn was dead or dying, and so also were the trees that were scattered about over the fields.

On reaching the main east-west highway we drew up to a filling station and got out of the car. It was only about 10:30 in the morning, yet the thermometer that was hanging in the shade of the building registered 114° F. Under such conditions, it did not seem worth while to go on to Oklahoma.

Coming back through Missouri the only green fields we saw were those that had been planted to soybeans or alfalfa, and they looked like oases in a vast desert. The total production of wheat and corn in the United States that year was estimated at 2.1 billion bushels. This is less than half the amount of these two grains that was produced each year during World War II.

If the 1934-36 dry-weather cycle had been delayed another 10 years, so that it would have occurred during the war, we and our allies would have found it extremely difficult, if not impossible, to have won the war. Fortunately, the weather was so favorable that we were able to harvest the largest tonnages of feed and food crops this country has ever known. The people of the United States ate more and better food during World War II than ever before. Meanwhile heavy demands were being made on our food reserves for shipment abroad, and these have been continued up to now. Grain carry-over was so short in 1946 that when the poor corn year of 1947 came along, even though it was an excellent year for wheat, a serious grain shortage developed.

The two horns of our present dilemma are: (a) the joint possibilities of another cycle of dry years and continued demand for very large amounts of food for Europe, and (b) the reverse situation of favorable weather and resulting high yields in the United States and sufficient agricultural recovery among the European nations so that they can meet most of their own food needs. Accordingly it becomes necessary to consider ways and means of dealing with the problem of possible agricultural overproduction if and when the worst of these two contingencies comes to pass.

During the past summer, 1947, I drove some 6,000 miles through the tobacco-cotton South, the cattle-wheat Southwest, the corn-hog Central States, and the grassland-dairy Northeast. One of the results of that trip was a highly favorable impression of the remarkable progress that has been made during recent years in the development of greatly improved techniques in farming. Another was a greater appreciation of the tremendous agricultural potentialities of this vast and highly progressive country in which we live.

Among the many observations of great interest to one who is concerned with better land use I have chosen a dozen items to call to your special attention:

1. The cotton area of the United States has dropped from 43 million acres, at the 1929 peak, to around 20 million acres, or less than half. Yet the total number of bales harvested has been reduced only about 20 per cent.

Some 23 million acres of cotton land have been released for other agricultural uses.

2. Kudzu, a long-vine legume, is now being widely used in the South as a soil-renovator and an erosion-stopper. It not only is taking over the waste land but it is climbing to the tops of the highest trees and it would cross the highways, except for the automobile wheels that cut off the ends of the vines.

3. The U. S. Forest Service is demonstrating on a 4½-million-acre scale in Louisiana that reforestation of non-agricultural land can be made a highly profitable enterprise. Newly planted trees, rightly cared for and protected against fire, are reaching the harvesting stage for pulpwood in seven years. An enormous cut-over area is being brought back from poverty to prosperity.

4. Contour-farming, with supporting terraces, is now being employed on a tremendous scale in the Cotton Belt to save both soil and water. This is making it possible to do away with one-man-one-mule farming and to use modern machinery on an ever-enlarging scale.

5. Texas cattlemen are now building large storage ponds to save the water from the heavy but too infrequent rains. These not only meet the needs of livestock but, in some cases, provide water for irrigation as well.

6. Prominent industrialists of Dallas, Texas, have financed the purchase of a large tract of nearby black prairie land for a Texas State Research Institute and have provided for its liberal support. One of the primary aims of this agency is to develop improved methods for the 9-million-acre Blackland Belt in that State. These men propose to erase the handwriting of erosion that, until it is stopped, will continue to spell ruin to this exceptionally fine agricultural area.

7. Combine-sorghums are growing rapidly in favor in Texas, Oklahoma, and Kansas. When the 40 per cent improvement in yield that is fully expected from the hybridization of these grain sorghums has been effected, greatly enlarged production of this highly important dry-land grain crop is certain to occur.

8. One-way disc plows, with 26 discs each that cut a 15-foot swath, are now being used, singly and in gangs, with a high degree of speed and efficiency for preparing land for seeding in the Wheat Belt. This implement mixes the straw with the surface soil where it aids greatly in absorbing the rainfall and stopping wind and water erosion.

9. Farmer-cooperative elevators, holding as much as six million bushels each, are being built in ever-increasing numbers to house the tremendous wheat crops of Oklahoma and Kansas. These modern elevators have suction fans that operate, while the grain is being unloaded, to collect the dust. At one such set of elevators 30 carloads of dust, containing 12 per cent protein, were saved and sold for use in mixed feeds.

10. One-man balers are now in operation both in the wheat and hay fields from way west of the Mississippi River clear to the Atlantic Coast. These do a lot of work with very little labor but a high degree of efficiency.

11. The concept of 100-bushel-per-acre yields has spread through the Corn Belt. Corn growers are sold on hybrid seed and thicker stands and they are beginning to pour on lime and fertilizer.

12. Irrigation is being rapidly expanded not only in the arid areas of the United States but in the high-rainfall areas as well. Extra water is being applied on an ever-enlarging scale to vegetables and potatoes in the humid areas, and some of it is spilling over onto haylands and pastures.

These are only a few of the many developments in agricultural practice that are having highly important effects on our farm economy. These improved techniques are taking a great deal of the gamble out of the production and sale of crops and livestock. But they are only the beginning of a rapidly expanding program that is being designed to tie the soil down, improve its productivity, and stabilize the agriculture in this country.

It must be pointed out, however, that a gigantic task still remains to be done. For example, it was necessary to make a wide detour to avoid the flooded areas of central Missouri. As soon as public approval can be obtained, the red rivers of the Cotton Belt, the gray-brown rivers of the Wheat Belt, and the gray-black rivers of the Corn Belt must be made to run clear. Vast plans have been conceived to soak in the rain where it falls and to hold the excess water upstream until it no longer constitutes a menace to the people and to the land farther down the watershed. A typical example is found in the trash-farming program that is being applied to over one million acres of Nebraska corn land. The farmers in that area are discarding the mold-board plow. And that is a mere beginning to the many changes that must and will be put into effect out in the open country where the floods have their origin.

To the man who thinks in terms of soils and the fertility problems related

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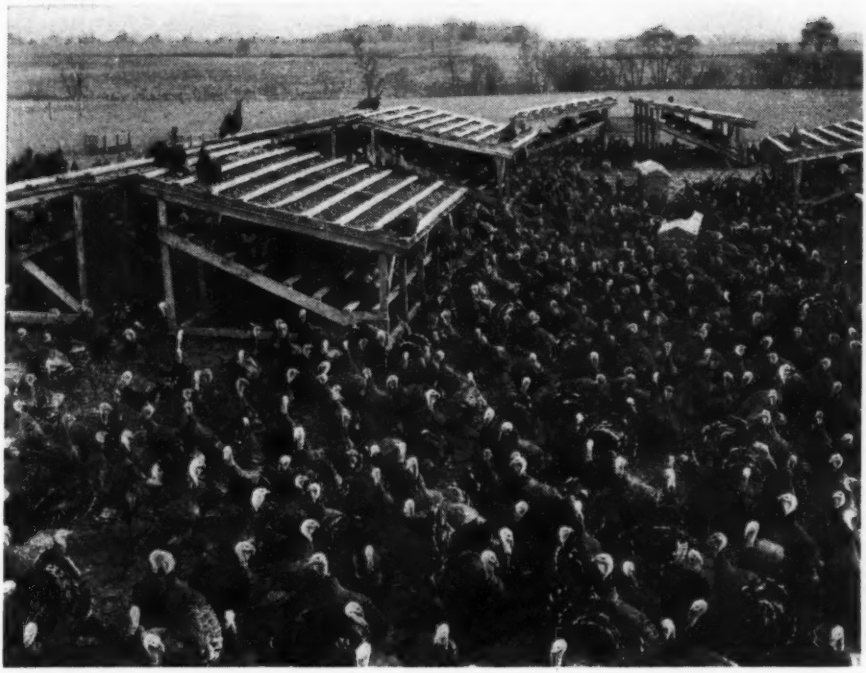
PICTORIAL

ALWAYS HUNGRY!

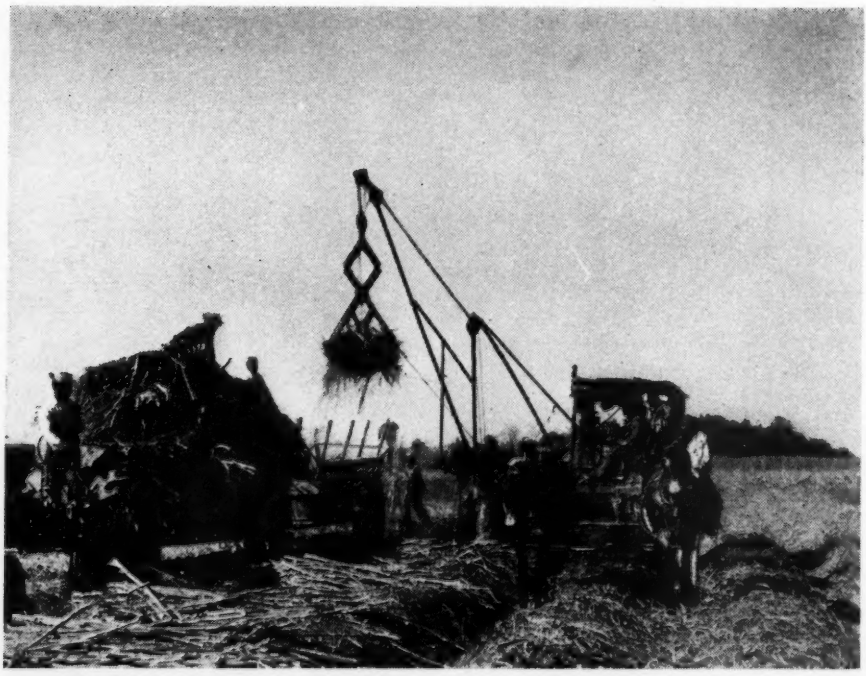
Some of our American Bounty



For Which to Give Thanks

Above: **The worry over this year's corn crop is ended.**

Below: **Sugar cane on its way to the Nation's sweet-tooth.**



The Editors Talk

Our Nation's Land Resources

One travels the "open spaces" and, viewing the broad expanses of cropland, range, and forest, is impressed with the Nation's land resources. One reads the astronomical figures of our crop production and livestock population and congratulates himself on living in a land of plenty. Yet few of us, except that they be of a particularly statistical mind, have any conception of the comparatively small percentage of our land area that keeps us alive.

We have Claude C. Haren of the Bureau of Agricultural Economics, U. S. Department of Agriculture, to thank for a comprehensive breakdown of the major uses of land in the United States in 1945. With text and graph published in the October 1947 issue of *The Agricultural Situation* he has presented some thought-provoking information.

"Less than one-fifth of the Nation's land area provides, directly as foodstuffs or fibers or indirectly as feed and forage for livestock, most of the agricultural products which go to meet our needs," he says. "The 350 million acres, more or less, from which crops have been harvested in recent years represent 2½ acres per capita. The 200 or more crops grown include all of the major crops except certain tropical and subtropical commodities. About two-thirds of the acreage of crops harvested and an even larger part of the tonnage go to provide feed for livestock. One-fifth of the acreage is utilized for growing wheat, rice, and similar crops, staples in the diet of a large proportion of the population of the world. About one-tenth of an acre per capita is used to produce fruits and vegetables. The fiber, oil-producing, and other crops account for the remaining one-tenth of the acreage of harvested crops."

To what uses is the rest of our land area put? Crop, pasture, grazing, and forest uses add up to slightly over 1,700 million acres, or 90 per cent of the land area of the country, according to Mr. Haren. Of the remaining 10 per cent, 3.7 per cent is occupied by cities, parks, roads, railroads, etc., and 2.3 per cent by farmsteads, roads, lanes and farm wasteland. The remaining 4 per cent or 78 million acres of desert, rock outcrop, tidal marshlands, and coastal beaches, is of slight agricultural value, although these areas have some usefulness for wildlife protection and as recreational sites.

For years we have been hearing that the limitations to our agricultural frontiers have been reached. Still the output of farms and ranches each year since 1940 has averaged a fifth above 1931, the pre-drought peak, and over a third above 1920. Farmers since 1941 have been growing record amounts of most crop and livestock products without much increase in their acreage of crop, pasture, and grazing land.

Altogether, more than half of our land area is used or available for pasture for farm and range livestock. These areas now provide at low cost about a third of the feed and forage requirements of these animals. "Changes in consumers' food habits during the past three decades have increased the value of

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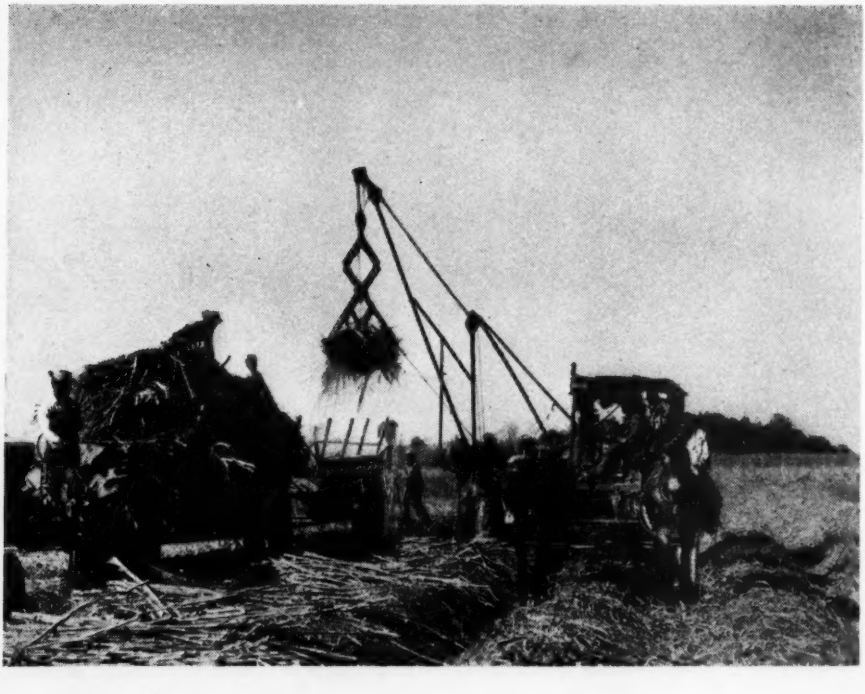

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Altogether, more than half of our land area is used or available for pasture for farm and range livestock. These areas now provide at low cost about a third of the feed and forage requirements of these animals. "Changes in consumers' food habits during the past three decades have increased the value of

this pasture resource," Mr. Haren says, "but pasture improvement, despite gains through reseeding, use of fertilizers, and application of soils and moisture stabilizing measures in recent years, remains an important but largely undeveloped field."

There is much more of interest in this analyst's report. He discusses forest-producing land which has dwindled to 56 per cent of the originally forested area. The significant thought of his whole discussion lies in his concluding sentence on forests: "Future dependence, as upon crops and pastures but over long-time growth interval, must be placed upon present and prospective increments." In other words, it is up to us to take care of and constantly improve what we now have.

The Soil Bank Account

A man's bank account is of vital interest to himself and to those with whom he does business. The regularly issued statements of his deposits, withdrawals, and balance receive his prompt attention. He wants to see what he has accumulated, what he has had to take out, and what is left on which he can base his future operations. Why, then, do so many farmers neglect to check into the fertility of their soils—a bank account as truly as any which they may carry at a commercial bank? From this fertility must come their chief income. On it, their successful operations depend.

This is an excellent time of the year for a farmer to get a statement from his soil bank account. Crops have been harvested and livestock is moving to market. The fertility withdrawals have been made. What did they produce and what is the balance left? The year's accomplishments are being summed up and plans for next year are beginning to take shape. There is time to look into these things and to consider the plant-food requirements of the crops to be planted next spring. In other words, this is an excellent time of the year for a farmer to have his soils tested.

There are other reasons than those given above for this statement. The experiment stations and soil-testing laboratories which make the tests are less "swamped" with soil samples than during the spring and can be more prompt in getting their reports back to the farmer. This will give him more time for making his inventory and future plans and will permit him to get his order for fertilizer in early—an important factor in assuring him that he will have it when he wants to apply it. Spring is the farm's busiest season and anything done ahead is time gained.

A great many farmers are taking advantage of these opportunities. However, they are open to and should be realized by a vast number who still are indifferent to them. Anything the advisory forces can do to encourage more operators to have their soils tested is an accomplishment toward the bettering of American agriculture.

We are founded as a nation of farmers and in spite of the great growth of our industrial life, it still remains true that our whole system rests upon the farm; that the welfare of the whole community depends upon the welfare of the farmer; the strengthening of country life is the strengthening of the Nation.—*Theodore Roosevelt.*

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1922	22.9	22.8	65.9	100.4	74.5	96.6	11.64	30.42	....
1923	28.7	19.0	92.5	120.6	82.5	92.6	13.08	41.23	....
1924	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941	17.0	26.4	80.7	94.0	75.1	94.5	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945	22.4	42.6	139.0	200.0	114.0	149.0	15.10	51.80	....
1946									
October	37.69	53.0	122.0	209.0	171.0	188.0	16.10	66.00	....
November	29.23	43.8	123.0	200.0	127.0	189.0	17.20	89.90	....
December	29.98	43.5	126.0	210.0	122.0	192.0	17.70	91.50	....
1947									
January	29.74	39.0	129.0	220.0	121.0	191.0	17.50	90.40	....
February	30.56	31.9	131.0	228.0	123.0	199.0	17.50	88.20	....
March	31.89	33.6	139.0	235.0	150.0	244.0	17.40	88.00	....
April	32.26	30.1	147.0	233.0	163.0	240.0	17.20	88.00	....
May	33.50	44.6	153.0	233.0	159.0	239.0	16.80	83.70	....
June	34.07	46.0	156.0	249.0	185.0	218.0	16.00	79.60	....
July	35.88	48.5	169.0	251.0	201.0	214.0	15.10	79.00	....
August	33.15	38.1	161.0	270.0	219.0	210.0	15.30	75.50	....
September	31.21	40.7	149.0	240.0	240.0	243.0	16.10	75.60	....
Index Numbers (Aug. 1909—July 1914 = 100)									
1922	185	228	95	114	116	109	98	135	....
1923	231	190	133	137	129	105	110	183	....
1924	185	190	98	170	166	141	107	147	143
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	93	81	109	74	87	110
1938	69	196	80	83	76	64	57	97	88
1939	73	154	100	85	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	107	117	107	81	211	129
1942	153	369	168	136	143	124	91	202	163
1943	160	405	188	232	174	154	125	231	245
1944	167	420	214	219	170	160	138	234	212
1945	181	435	199	228	178	169	127	230	224
1946									
October	304	530	175	238	266	213	136	293	151
November	236	438	176	228	198	214	145	399	207
December	242	435	181	239	190	217	149	406	166
1947									
January	240	390	185	351	188	216	147	401	238
February	246	319	188	260	192	225	147	391	275
March	257	336	199	268	234	276	147	390	299
April	260	301	211	265	254	271	145	390	295
May	270	446	220	265	248	270	142	371	286
June	275	460	224	284	288	247	135	353	215
July	289	485	242	286	313	242	127	350	189
August	267	381	231	308	341	238	129	335	211
September	252	407	214	273	374	275	136	335	179

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1923	3.02	2.90	6.19	4.83	4.59	5.16
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946						
October	2.22	1.46	13.20	7.12	8.30	12.14
November	2.22	1.46	15.19	11.26	12.14	12.75
December	2.22	1.46	14.63	11.37	12.14	11.17
1947						
January	2.36	1.46	12.98	11.06	12.14	10.32
February	2.41	1.46	10.01	11.06	12.14	10.17
March	2.41	1.46	11.98	11.06	12.50	10.50
April	2.41	1.51	11.72	10.79	12.75	11.39
May	2.41	1.51	10.55	9.98	12.75	8.80
June	2.41	1.51	10.94	9.98	12.75	8.26
July	2.41	1.59	12.56	9.98	12.75	8.66
August	2.53	1.60	13.01	9.98	12.75	8.73
September	2.66	1.73	13.65	10.41	12.75	10.72

Index Numbers (1910-14 = 100)

1923	112	102	177	137	136	147
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946						
October	83	51	377	202	246	345
November	83	51	434	319	360	362
December	83	51	418	322	360	317
1947						
January	88	51	371	313	360	293
February	90	51	286	313	360	289
March	90	51	342	313	371	298
April	90	53	335	306	378	324
May	90	53	301	283	378	250
June	90	53	313	283	378	234
July	90	56	359	283	378	246
August	94	56	372	283	378	248
September	99	61	390	295	378	305

Wholesale Prices of Phosphates and Potash **

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1923	.550	3.08	7.50	.588	.836	23.32	....
1924	.502	2.31	6.60	.582	.860	23.72	....
1925	.600	2.44	6.16	.584	.860	23.72	....
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	.415	.684	21.44	.444
1936	.476	1.85	5.50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.9	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367[1]
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946							
October	.700	2.60	6.60	.471	.729	22.88	.176
November	.700	2.60	6.60	.535	.797	26.00	.200
December	.700	2.60	6.60	.535	.797	26.00	.200
1947							
January	.700	2.60	6.60	.535	.797	26.00	.200
February	.720	2.60	6.60	.535	.799	26.00	.200
March	.740	2.75	6.60	.535	.797	26.00	.200
April	.740	2.97	6.60	.535	.797	26.00	.200
May	.740	2.97	6.60	.535	.797	26.00	.200
June	.752	2.97	6.60	.330[1]	.589[1]	12.76[1]	.176
July	.760	2.97	6.60	.353	.629	13.63	.188
August	.760	3.08	6.60	.353	.629	13.63	.188
September	.760	3.42	6.60	.353	.629	13.63	.188

Index Numbers (1910-14 = 100)

1923	103	85	154	82	88	96	....
1924	94	64	135	82	90	98	....
1925	110	68	126	82	90	98	....
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1920	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946							
October	131	72	135	66	76	95	80
November	131	72	135	75	84	108	83
December	131	72	135	75	84	108	83
1947							
January	131	72	135	75	84	108	83
February	134	72	135	75	84	108	83
March	138	76	135	75	84	108	83
April	138	82	135	75	84	108	83
May	138	82	135	75	84	108	83
June	140	82	135	60	62	53	80
July	142	82	135	64	66	56	82
August	142	85	135	64	66	56	82
September	142	95	135	64	66	56	82

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1923.....	143	152	147	114	107	144	103	79
1924.....	143	152	143	103	97	125	94	79
1925.....	156	156	151	112	100	131	109	80
1926.....	146	155	146	119	94	135	112	86
1927.....	142	153	139	116	89	150	100	94
1928.....	151	155	141	121	87	177	108	97
1929.....	149	154	139	114	79	146	114	97
1930.....	128	146	126	105	72	131	101	99
1931.....	90	126	107	83	62	83	90	99
1932.....	68	108	95	71	46	48	85	99
1933.....	72	108	96	70	45	71	81	95
1934.....	90	122	109	72	47	90	91	72
1935.....	109	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	122	131	126	81	50	129	95	75
1938.....	97	123	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	131	127	86	56	130	102	77
1942.....	159	152	144	93	57	161	112	77
1943.....	192	167	151	94	57	160	117	77
1944.....	195	176	152	96	57	174	120	76
1945.....	202	180	154	97	57	175	121	76
1946								
October...	273	218	197	115	67	286	131	70
November.	263	224	198	127	67	382	131	78
December..	264	225	204	127	67	376	131	78
1947								
January...	260	227	206	126	69	359	131	78
February..	262	234	209	124	70	329	134	78
March.....	280	240	216	128	70	354	138	78
April.....	276	243	215	129	71	354	138	78
May.....	272	242	215	127	71	339	138	78
June.....	271	244	215	125	71	343	140	63
July.....	276	244	219	128	72	359	142	67
August....	276	249	223	130	75	364	142	67
September.	286	252	230	133	79	372	142	67

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash are lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Commercial Fertilizers Registrants to Date for the Fiscal Year Ending June 30, 1947," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., FM-152, Sept. 22, 1947.

"Agricultural Minerals Registrants to Date for the Fiscal Year Ending June 30, 1947," Bu. of Chem., State Dept. of Agr., Sacramento, Calif., FM-153, Sept. 22, 1947.

"Commercial Fertilizers Report for 1946," Agr. Exp. Sta., New Haven, Conn., Bul. 502, Dec. 1946, H. J. Fisher.

"Fertilizer, Feed, Limes and Seed Report for Quarter Ending June 30, 1947," State Laboratory, Board of Agr., Dover, Delaware, Vol. 37, No. 2.

"Commercial Fertilizers Inspected and Analyzed in the State of Georgia, Year 1946," State Dept. of Agr., Atlanta, Ga., Serial No. 131, Jan. 1947.

"Fertilizers, Fertilizer Materials and Rock Phosphate Used in Illinois During 1946," Agr. Exp. Sta., Univ. of Ill., Urbana, Ill., July 1947, E. E. DeTurk.

"The Effect of Fertilizer Practice Including the Use of Minor Elements on Stem-end Browning, Net Necrosis, and Spread of Leaf-roll Virus in the Green Mountain Variety of Potato," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 447, Jan. 1947, A. Frank Ross, Joseph A. Chucka, and Arthur Hawkins.

"Results of Fertilizer Tests of Sugarcane in Mississippi During the Period 1941-1946," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 446, May 1947, I. E. Stokes and T. E. Ashley.

"Ammonia as a Source of Nitrogen," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 448, June 1947, W. B. Andrews, F. E. Edwards, and J. G. Hammons.

"County Fertilizer Data: Mixed Goods and Materials, July 1, 1946 through June 30, 1947," State Dept. of Agr., Jackson, Miss.

"Effect of Fertilizers and Lime on Yield, Protein Content, and Phosphoric Acid Content of Pasture Forage," Agr. Exp. Sta., Texas A. & M., College Station, Texas, P. R. 1039, Oct. 2, 1946, E. B. Reynolds and R. H. Wyche.

"Fertilizer Experiments with Tomatoes in Robertson County," Agr. Exp. Sta., Texas A. & M., College Station, Texas, P. R. 1080, May 24, 1947, Myron D. Bryant.

"Auto Rear-end Type Fertilizer Spreader," Agr. Ext. Serv., Texas A. & M., College Station, Texas, L-50, 1946.

"Boron for Vermont Soils and Crops," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 539, Aug. 1947, A. R. Midgley and D. E. Dunklee.

Soils

"Organic Matter in Florida Soils," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 433, July 1947, L. G. Thompson, Jr. and F. B. Smith.

"Plant Beds for Flue-Cured Tobacco," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 435, Aug. 1947, Fred Clark, G. M. Volk, and W. E. Stokes.

"Cultural Directions for Growing Mangos in Florida," Sub-Tropical Exp. Sta., Univ. of Fla., Homestead, Fla., Mimeo. Rpt. No. 10, June 1945 (rev. April 1947), Geo. D. Ruehle.

"How to Reseed Abandoned Land for Pasture and Range in Southern Idaho," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Cir. 112, Feb. 1947, R. H. Stark, J. L. Toevs, and A. L. Hafenrichter.

"Physical Land Conditions of the Fruit Breeding Farm at the New York State Experiment Station, Geneva, N. Y.," Agr. Exp. Sta., Cornell Univ., Geneva, N. Y., Tech. Bul. 279, Feb. 1947, Wilber Secor, Everett A. Carleton, and John Lamb.

"Removal of Alkali by Drainage and Leaching," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Bul. No. 276, June 1946, T. J. Dunnewald.

"The Form of Selenium in Some Vegetation," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Bul. No. 278, March 1947, O. A. Beath and H. F. Eppson.

Crops

"Grain Sorghum Production in Alabama," Agr. Exp. Sta., Ala. Polytechnic Institute, Auburn, Ala., P. R. Series No. 34, June 1947, D. G. Sturkie and T. H. Rogers.

"White Dutch Clover-Dallis Grass Pasture for the Gulf Coast Area of Alabama," Agr. Exp. Sta., Ala. Polytechnic Institute, Auburn, Ala., P. R. Series No. 36, Aug. 1947, Otto Brown and Harold F. Yates.

"Fifty-Seventh Annual Report for the Year Ending June 30, 1946," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz.

"The California Avocado Industry," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 43 (rev. April 1947), Robert W. Hodgson.

"Results of Experiments, 1937-1945," Dominion Exp. Substation, Dept. of Agr., Delhi, Ontario, Canada, F. A. Stinson.

"Physiology of Fusarium Foot Rot of Squash," Agr. Exp. Sta., New Haven, Conn., Bul. 500, Nov. 1946, George A. Gries.

"Annual Report of the Director for the Fiscal Year Ending June 30, 1946," Agr. Exp. Sta., Newark, Del., Bul. No. 263, Feb. 1947.

"Annual Report for the Fiscal Year Ending June 30, 1946," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla.

"Growing Bananas in Florida," Sub-Tropical Exp. Sta., Univ. of Fla., Homestead, Fla., Mimeo. Rpt. No. 11, Dec. 1946, Geo. D. Ruehle.

"Growing Guavas in Florida," Sub-Tropical Exp. Sta., Univ. of Fla., Homestead, Fla., Mimeo. Rpt. 12, Feb. 1947, Geo. D. Ruehle.

"Twenty-Sixth Annual Report, 1945-1946," Ga. Coastal Plain Exp. Sta., Tifton, Ga., Bul. 43, July 1946.

"Winter Cover Crops," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 300 (Rev. Aug. 1946), E. D. Alexander.

"Lespedeza for Permanent and Temporary Pastures, Hay, Seed, Soil Conservation and Improvement," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Cir. 307 (Rev. April 1947), E. D. Alexander and J. B. Preston.

"Dixie Crimson Clover," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Press Bul. 576, Dec. 30, 1946, Julius M. Elrod.

"Progress Report on Corn Variety and Hybrid Tests," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Press Bul. 577, Jan. 2, 1947, G. A. Lebedeff.

"A New Wheat for Georgia," Agr. Exp. Sta., Univ. of Ga., Athens, Ga., Press Bul. 591, Sept. 15, 1947, U. R. Gore.

"Strawberries for Home and Market," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., Ext. Bul. No. 174 (6th rev.), 1947, Clarence E. Baker, Howard O. Deay, Eric G. Sharvelle, and Paul Ulman.

"Raspberries and Blackberries," Dept. of Agr. Ext., Purdue Univ., Lafayette, Ind., Ext. Bul. 191 (4th rev.), 1947, Clarence E. Baker, J. J. Davis, and Eric G. Sharvelle.

"House Plants," Agr. Ext. Serv., Purdue Univ., Lafayette, Ind., Ext. Bul. No. 206 (2nd Rep. Rev.), 1947, E. R. Honeywell.

"Flower Gardening in Maine," Agr. Ext. Serv., Univ. of Maine, Orono, Maine, Ext. Bul. 363, June 1947, Roger Clapp.

"Highlights of the Work of the Mississippi Experiment Station," Agr. Exp. Sta., Miss. State College, State College, Miss., Fifty-Ninth Annual Report for the Fiscal Year Ending June 30, 1946.

"Mississippi Delta Peach Culture," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 444, April 1947, L. R. Farish.

"Problems of Growing Cucumbers," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 390, May 1947, W. S. Anderson.

"Agricultural Research in New Hampshire," Agr. Exp. Sta., Univ. of N. H., Durham, N. H., Bul. 363, Nov. 1945, Annual Report of the Director for Year Ending June 30, 1945.

"Fifty-Ninth Annual Report," Agr. Exp. Sta., College of Agr., Cornell Univ., Ithaca, N. Y., 1946.

"Ladino Clover Pastures for Cattle, Poultry, Hogs," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 301, May 1947, R. L. Lovvorn and S. H. Dobson.

"North Carolina Needs Home-Grown Grain," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 304, Aug. 20, 1947.

"Fall, Winter, and Spring Grazing to Save Grain Feed," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. 310, Aug. 1947.

"Comparative Effects of Season, Location, and Variety on the Yield and Quality of North Dakota Hard Red Spring Wheat," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Bul. 342, Jan. 1947, R. H. Harris, L. D. Sibbitt, L. R. Waldron, and T. E. Stoa.

"Studies on Wild Buckwheat," Agr. Exp. Sta., N. D. Agr. College, Fargo, N. D., Bul. 346, May 1947, O. A. Stevens.

"Farm Science and Practice," Agr. Exp. Sta., Wooster, Ohio, Bul. 665, Sixty-fourth Annual Report, Oct. 1946.

Economics

"California Bartlett Pears Economic Status, 1946-47," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 368, April 1947, Sidney Hoos and S. W. Shear.

"Statistical Supplement to Agricultural Experiment Station Circular 368," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., April 1947.

"San Joaquin County, 1946—Third Annual Pasture Management Cost Study," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., 1947, B. B. Burlingame and Dan L. Dieter.

"Irrigated Pasture Efficiency Study, Yolo County, 1946—Third Annual Report and Three Year Summary," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., 1947, B. B. Burlingame and W. M. Herms.

"Pillars of Profitable Farming," Agr. Ext. Serv., Univ. of Ga., Athens, Ga., Bul. 536, Dec. 1946, J. William Fanning.

"Summary of Annual Farm Business Reports of 2,565 Illinois Farms for the Year 1946," Agr. Ext. Serv., Univ. of Ill., Urbana, Ill., Numbers 146 and 147, July-Aug. 1947, J. B. Cunningham, A. G. Mueller, and F. J. Reiss.

"The Importance of Sugar Beets to Michigan Farmers," Agr. Exp. Sta., East Lansing, Mich., Quarterly Bulletin, Vol. 29, No. 4, May 1947, K. T. Wright.

"Quality of Cotton Produced in New Mexico 1940-1943," Agr. Exp. Sta., N. M. A. & M., State College, N. M., Bul. 330, June 1946, F. A. B. MacKeil and J. C. Overpeck.

"The Farmer, North Carolina, and the TVA," Agr. Ext. Serv., Univ. of N. C., Raleigh, N. C., Ext. Cir. No. 289, June 1946, W. B. Collins.

"The Price of Texas Farm and Ranch Lands, 1920-1945," Agr. Exp. Sta., Texas A. & M., College Station, Texas, Bul. No. 688, April 1947.

"Rural Non-Farm Family Living in Nine Vermont Towns," Agr. Exp. Sta., Univ. of Vt., Burlington, Vt., Bul. 537, Aug. 1947, Robert M. Carter.

"Washington 4-H Clubs," Agr. Ext. Serv., State College of Wash., Pullman, Wash., Ext. Bul. No. 363, April 1947.

"Marketing Margins and Costs for Grains, Grain Products, and Dry Edible Beans," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., Tech. Bul. No. 934, Aug. 1947, Donald R. Stokes.

At the Tip of the Shoot and the Point of the Root

(*From page* 18)

the summer when I was a boy was between two buildings. For some reason the soil there was always moist—it felt nice and cool to our bare feet. The shade that kept the soil cooler than the surroundings was responsible for that moisture. This is a fact most of us overlook, and to better understand it can prove valuable.

Several years ago the late Professor A. R. Whitson of the Wisconsin Experiment Station told me how he was comparing the moisture content in the soil in a soybean plot with that in an uncropped plot. In August the soil moisture under the soybeans was actually higher than in the plot where no crops were growing. This did not seem reasonable, because we realize the soys were drawing heavily upon the soil water and were evaporating much of it into the air, whereas no plants were using water in the fallow plot. At that time we had no explanation for the difference.

In 1927 the answer came from a Russian named Lebedev who had spent his life studying soil moisture. He found that when the soil cooled during the night, moisture from the air would move into the soil in the early morning and forenoon hours after sunup while the soil was cooler than the rapidly warmed air above the soil. In some tests he found that the amount of water thus entering the soil was equal to about ⅓ of the rainfall in Odessa where the tests were made.

Everyone is familiar with the wet ice-water pitcher and water glass, or knows how cold water pipes in the basement will become wet and even drip on a warm summer day. The soil under a board will be more moist than the adjacent soil. This is not due entirely to the board preventing evaporation, but is due in part to the shading effect of the board in keeping the soil underneath it a bit cooler than the surrounding atmosphere, thus permitting moisture from the air to move into the soil under the board and condense. It is difficult to maintain moisture in a hot soil but it is easy to keep a cool soil moist.

One of the great benefits derived from a mulch is that it keeps the soil cooler and thereby increases the moisture content in the soil; in fact it enriches the moisture content by actually drawing moisture into the soil from the air. There are data by Professors Gourley and Wander of Ohio State University which clearly indicate how a mulch will help the water situation. There are many other benefits derived from a good mulch.

Mulches Give the Roots a Chance to Feed on the Richer Topsoil

Plant roots cannot feed or grow in a dry soil. If a soil is not mulched, the topsoil will be dry during some weeks of every summer and thus plants are handicapped, which means a reduced growth and yield. It is in the topsoil

where most of the soil nitrogen is found. Undoubtedly the roots of trees and shrubs can feed on phosphorus and potash from the deep moist soil horizons, but they must feed out of the surface horizons for nitrogen. Therefore, it is important to keep that part of the soil moist throughout the entire growing season.

Mulches Help to Keep Soil Phosphate and Potash More Available

Excess drying of the soil tends to convert the nutrient elements, phosphorus and potassium, into crystalline unavailable forms. For this reason it is desirable that a soil should never become excessively dry. Available potash is held on the surface of the fine soil particles called colloids. These particles tend to be plate-like and expand when the soil is moist so that potash held between these plates can be obtained by the plant root. But excessive drying causes these plates to become "glued" together. When they are thus cemented they are very slow to separate again when the soil is wet. Therefore, it is better that they do not go through such a cementing process by excessive drying.

Mulches Increase Infiltration of Rain Water

Rain water should move into the soil rather than off the ground as so much of it does when the soil is hard and dense. Mulches prevent runoff and even though the mulch will hold a light shower from entering the soil there is still benefit from this high moisture content in the mulch in keeping the soil cool.

Mulches Improve Soil Tilth

The organic matter from mulches will furnish food for bacteria and fungi to live and multiply in the soil. Perhaps these micro-organisms give off healthy by-products, at any rate they help to granulate the soil to make it contain more pore space.

Mulches Can Do Damage

If a mulch is started, it should be maintained; otherwise it will encourage roots to become established near the surface. Then when the mulch has rotted away, the roots find themselves in the unprotected ground and trees and shrubs may suffer because of this.

Mulch Materials

The richer the mulch material is in important plant-food nutrient elements as nitrogen, phosphorus, and potassium, the greater will be the benefit from the mulch because of the nutrients thus supplied. Such mulches would be from legume crops or manures.

Sawdust mulches would help the water situation primarily. The high energy content of such materials may increase the need for nitrogen because much nitrogen is required to decompose all high energy materials as straw or sawdust that are high in cellulose but low in nitrogen content. Organic mulches like glass wool, gravel, or flagstones could only be beneficial as related to the moisture behavior and protection from erosion.

Mulches and Nitrogen Fertilizers

Theoretically a nitrate form of nitrogen should work better with organic mulches than the ammonium forms of nitrogen carriers. The nitrates are free to move into the soil, but ammonium nitrogen will not move deeply into a soil until converted through bacterial action to the nitrate form. Under high organic content mulches where the free oxygen supply is limited, it is doubtful if ammonium nitrogen forms will be changed over rapidly to the mobile nitrate forms.

Liming Orchard Soils

Liming orchard soils is risky business, especially on sandy soils, because such soils can be easily over-limed. The roots will have a hard time finding enough available iron, likely boron, and manganese wherever the soil pH is pH 7.0 or above.

Where a lot of sulphur sprays have been used over a period of years, the soil may be dangerously acid. Here it might actually even be deficient in calcium and magnesium. Light applications of dolomitic limestone (calcium and magnesium carrier) as if applying it for its plant-food content seems sensible.

Balanced Minerals

A well-fed tree needs all the minerals of life. Just because trees usually respond only to nitrogen fertilization does not mean that the other minerals are not needed. The needs vary too much with soil kind and past practices to dwell on here. A balance of nutrition is essential, and a sound procedure is to feed cover crops to use as mulches and then there will be a selection process by the organic matter producing crops to serve as a safety factor in feeding the trees.

As a layman apple watcher I think we still have a lot of opportunity to improve our tree performance from the root up and thus find ourselves lowering our cost of production.

Boron for Vermont Farms

(*From page* 24)

In making their recommendations for the use of boron, the agronomists warn that boron is not a cure-all. "It cannot replace other forms of plant nutrients; it merely supplements them. Nitrogen, phosphorus, potash, and lime are still the great quartette, but when boron is needed and properly used with them, decided benefits will result. Boron gives the greatest response on land well supplied with the other nutrients, because only a heavy and active plant growth requires much boron.

Fig. 5. This cross-section of a boron-deficient turnip shows brownish, corky tissue in the flesh. It is somewhat bitter and nearly worthless as food.

"Boron is like dynamite in that it is a very useful servant if used properly. It can be very helpful and beneficial, but used in excess it is harmful. Rates of boron tolerated by plants fall in a range much narrower than that for other fertilizers, and if a beneficial rate is doubled, injury may result," the authors warn.

Practically all the alfalfa stands in Vermont show signs of boron deficiency sometime during their life, Midgley and Dunklee state. They recommend broadcasting 40 to 50 pounds of borax on all Vermont soils before planting alfalfa. Borax greatly increases the life of the stand, improves yield, leafiness, and feeding value. Well-known boron-deficiency symptoms of alfalfa are: yellow top and terminal bronzing of the leaves, death of the terminal growing buds causing witches' broom, and lack of flowers and seed.

With apples the most outstanding symptom of a lack of boron is internal and external corky formation in the fruit. Apples showing internal cork have been obtained from practically every commercial orchard in Vermont, showing a widespread need for borax on apple trees. Most of Vermont's apple growers, however, are aware of the

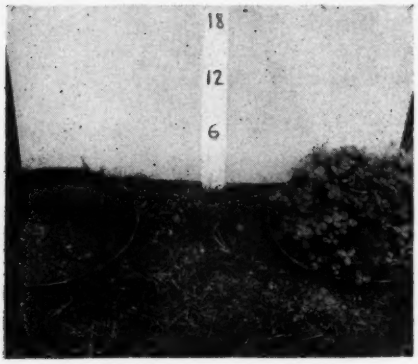


Fig. 6. With boron (right) Ladino clover grew well, but without it (left) it died in the seedling stage. Reseeding was not helpful as the deficient plants seemed to be more susceptible to damping-off.

need and have adopted the practice of applying one-half pound of borax for each medium-sized tree every other year. This is usually not enough unless it is applied in a band under the outer portion of the branches. When broadcast over the entire spread of the tree, the rate should be increased to at least one pound—about one pint.

When beet seed was planted on the boron-deficient soil, the plants often died in the seedling stage. Those that recovered, as well as healthy transplants placed in the same soil, produced typical beet canker and internal black spots. As beets have a high boron requirement, even a heavy application does not always guarantee against black spot and canker if a sufficient amount is not available to the plants.

With carrots Midgley and Dunklee experimentally obtained eight phases of boron deficiency; namely, yellows, bronzing of leaflets, dieback, multiple branching, death of seedlings, lack of flowers and seed, canker and splitting of exterior, and swelling of the nodes of second-year plants.

Grasses in general require very little boron, the agronomists found. They were able to produce sizable plants when seed was sown in the boron-lacking soil—in which other plants died in the seedling stage. With oats, however, a lack of boron may affect the formation of flowers and seed.

The best identification of boron-deficient Ladino clover was the bronzing of the leaflets, similar to the same symptom in alfalfa. Care must be exercised in using boron for Ladino clover, however, the agronomists caution, because new plants produce stolons that spread and root near the surface. Thus a heavy broadcast application on established stands may prove harmful—25 to 30 pounds per acre are recommended.

Experiments with potatoes and strawberries showed characteristic symptoms of boron deficiency when plants were grown in the special soil. Turnips were found to be good indicator plants of boron-deficiency. In fact, as they are widely grown in Vermont gardens, they are useful for this purpose.

All crops require boron for normal growth, but individual plant needs vary greatly. If the soil does not contain an adequate supply, some must be applied. A broadcast application of from 30 to 50 pounds per acre every three or four years will give most crops the needed insurance. However, when

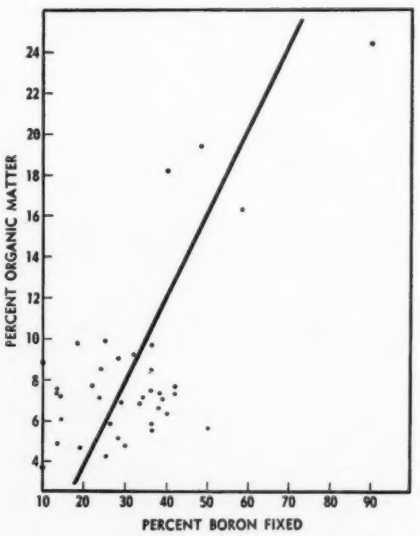


Fig. 7. Relation between boron fixation and organic matter content of 38 soils.

drilled, borax should not greatly exceed five pounds per acre. It is recommended by the authors that all fertilizers sold in Vermont carry some boron. Potato and perhaps garden fertilizer should not contain more than five pounds of borax per ton because the fertilizer is concentrated in rows. All other fertilizers should contain 10 pounds per ton because they are used at smaller rates.

Fertilizer Practice for the Ranger Sweet

(*From page* 12)

Summary

Observations of growers' practices and experimental work on the Ranger variety of sweet potatoes reveal, for average conditions, that 1,500 pounds of 3-9-12 fertilizer per acre are satisfactory. For good results 500 pounds of this mixture should be used before or at planting time, and the remainder as two side-dressings. This fertilizer should carry five pounds of borax per ton and from two to four per cent available magnesium oxide. If heavy rainfall occurs after the side-dressing, about 20 to 30 pounds of extra nitrogen as a late side-dressing should be used.

TABLE 3

THE INFLUENCE OF MAGNESIUM IN THE FERTILIZER UPON YIELD

Fertilizer Treatment	Magnesium Deficiency Observed	Yield Lbs./A.	% Increase over check
None	Moderate	11,200	.....
(1) 3–9–6	Moderate	15,040	34
(2) 3–9–12	Severe	15,040	34
(3) 3–9–18	Severe	15,360	37
(4) 3–9–12 2% MgO*	Some	16,000	43
(5) 3–9–12 4% MgO*	Some	16,160	44
(6) 3–9–12 2% MgO**	Some	16,160	44
(7) 3–9–12 4% MgO**	None	20,000	79

* Derived from magnesium sulfate.
** Derived from dolomitic limestone.

Are You Pasture Conscious?

(*From page* 16)

grazing animals. Rickets in young animals and general unthriftiness and low producing capacity in mature animals are characteristics of mineral deficiencies most frequently observed. When considering the mineral content of a pasture in relation to its nutritive value, it is necessary to have some standard of the requirements of animals for the different minerals. In the present state of our knowledge, according to Orr, the amount of minerals found in milk affords the best available standard for growing and lactating farm animals. The following table compares the amounts of important minerals found in the quantities of cow's milk and good pasture which yield 1,000 calories.

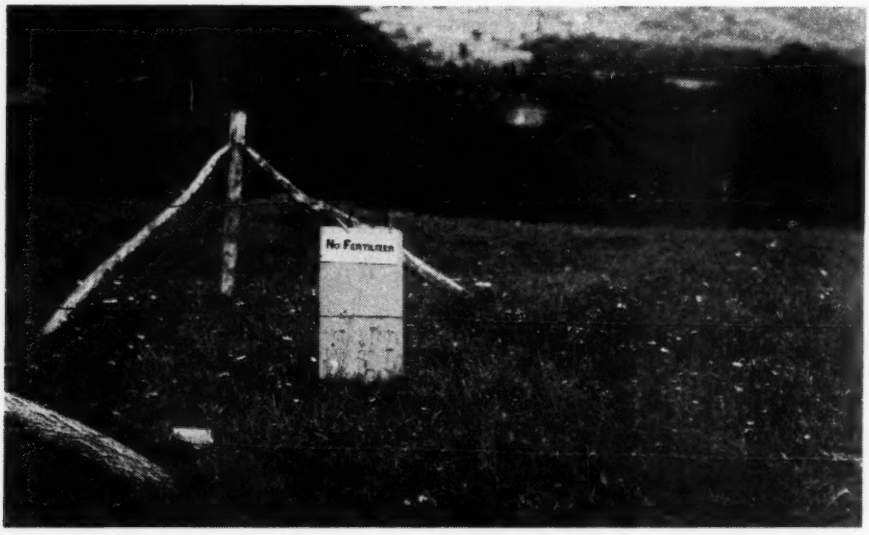


Fig. 5. A plot in a Pennsylvania pasture which received no fertilizer. Weight green grass—1,513 lbs. per acre.

It will be seen that there is a fairly close resemblance between the mineral content of good pasture and that of cow's milk. There is no natural foodstuff so well balanced in this respect as good pasture. The close correspondence of the mineral content of a good pasture to the mineral requirements of the animals is doubtless one of the most important factors in the high nutritive value of pasture for promoting growth and maintaining health of animals grazing thereon.

The mineral composition of different species of plants varies quite widely. The most outstanding difference is that between legumes and grasses. Legumes as a group tend to be richer than grasses in all of the minerals, especially in calcium. Grasses, however, are relatively richer in phosphorus than legumes. It is well known that the addition of clovers and other legumes to grasses increases the value of the grazing. This probably is due in some degree to the fact that the two together

COMPARISON OF MINERAL CONTENT OF GOOD PASTURE WITH OTHER FOODSTUFFS, WITH MILK AS THE STANDARD

(1,000 calories contain the following amounts in grams)

	Na_2O	CaO	P_2O_5	K_2O	Cl	N
Cow's Milk	0.81	2.38	3.43	3.21	1.4	8.32
Good Pasture	0.94	3.64	2.75	11.54	3.5	10.40
Maize	0.13	0.03	1.83	1.36	0.001	4.64
Wheat	0.13	0.14	2.75	1.59	0.2	5.60
Potatoes	0.49	0.28	1.60	5.56	0.3	3.36
Turnips	0.33	1.18	1.96	5.40	0.42	3.87
Decorticated Cotton Cake	0.24	1.22	11.26	8.05	0.11	26.32
Molasses	1.02	5.35	0.56	10.26	3.56	4.23

Fig. 6. A fertilized plot in same pasture as in picture opposite. Weight green grass—8,168 lbs. per acre.

in the proper proportions make a well-balanced diet. Data showing the preference of animals for fertilized pastures are numerous. Invariably a comparison of the chemical composition of samples from plots heavily grazed with those to which animals showed indifference reveals a significantly higher content of CaO, P_2O_5, Na_2O, K_2O, Cl, and N in the heavily grazed plots.

In a thought-provoking paper Dr. William Albrecht, University of Missouri, has pointed out that natural prairie grasses carry a high percentage of calcium and other cations including potassium. He further points out that leached soils may be so depleted of potassium as to interfere seriously with the production of proteinaceous plants. The theory advanced by Dr. Albrecht in respect to the importance of calcium and potassium in producing plants carrying a relatively high content of nitrogen, such as the grasses and clover, suggests very careful consideration of their importance in any pasture fertilization program.

White clover is sometimes styled the key to pasture improvement. By many authorities it is regarded as an excellent indicator of mineral deficiencies. When it fails, it is a reasonably sure sign that the supply of potash, phosphorus, and/or lime is deficient. The importance of mineral plant food in increasing yield and quality of herbage as well as for the health and productive capacity of animals gives a high degree of significance to this type of fertilization. A deficiency of minerals is usually associated with deficiency of protein and absence of properties such as leafiness and succulence on which the nutritive value of pastures depends so much.

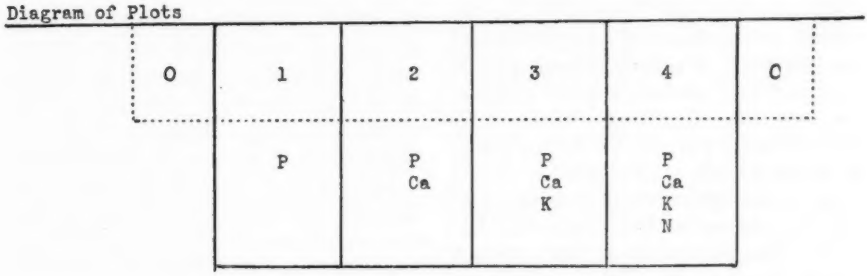
The old axiom, "take care of the legumes and the grasses will take care of themselves," is being put into practice throughout the humid areas of the United States. The big problem in this connection is quite naturally that of supplying the necessary minerals, lime, phosphorus, and potash, before planting the legume. The second most important probably is that of selecting the legume best suited to the particular soil and climatic conditions. White clover, the premier legume for growth in association with grasses, does best under cool, moist growing conditions.

In the Northeastern States Ladino clover, a giant type of white clover, is receiving a great deal of attention. It is a triple-purpose crop—valuable for hay, pasture, or silage. It is distinguished from ordinary white clover by having much larger leaflets and taller stems. Owing to its more erect growth, it is able to compete with tall-growing grasses and legumes. Although not so well adapted to closely grazed pasture sods as the smaller types of white clover, under favorable management and liberal mineral fertilization, Ladino is permanent and produces large yields of high quality feed.

Except on soils unsuited to the growing of pastures because of poor drainage, their shaly, sandy, or stony character, a system of fertilization that will supply an abundance of the necessary plant-food elements may be expected to increase the carrying capacity of pastures from 50 to as much as 100 per cent. There are many dairy and livestock farms in the Northeastern pasture region where pastures are so fertilized and managed as to provide the bulk of feed requirements of the herd from May 1 to October 15. On such farms milk or other livestock products are produced much more cheaply and with much less labor than on the average farm where only about 2½ months of grazing can be counted on. Stretching the pasture period from the low average of 2½ to possibly 5½ or 6 months by proper fertilization and management has been found to be easily possible.

If one is pasture conscious and desirous of better economic returns from his livestock enterprise, he owes it to his animals, to say nothing of his pocketbook, to waste no time in consulting with the pasture research and extension men of his State Agricultural Experiment Station. These men have the 'Know How' based on research.

Diagram of Plots



A SIMPLE PLAN FOR PASTURE TOP-DRESSING TEST

Explanation: **Four plots, each 2 x 8 rods 1/10 acre. Fertilizer and lime applied by hand, minerals in fall when possible and nitrogen in early spring following. All may be applied in early spring if necessary. Plant-food ratio N-P-K 1-2-2. Cattle to be fenced out of one end of plots and small areas of untreated land (0) each side (above dotted line) from the start and until growth response can be observed and recorded. Selection of Test Plots: In all cases test plots to be located on pasture land that is reasonably free from brush, well supplied with moisture, and not exhausted to the point where the desirable species of pasture plants have completely disappeared.**

A little boy on return from Sunday School asked his mother if it was true that when people were born they came from dust, and when they die they return to dust. "Yes," replied mother. "Well, mummy," commented the youngster, "someone is either going or coming under my bed."

The doctor's waiting-room was very full. Every chair was taken and some patients were standing. There was a desultory conversation, but after a while a silence fell and the patients sat waiting. Finally, an old man stood up wearily and remarked: "Well, I guess I'll go home and die a natural death."

Fall and Winter Grazing in Mississippi

(*From page* 21)

represented in both tours, since some were rained out April 11.

Farm visits were made to all 30 demonstrations during the last of April and up to May 22, collecting data and making colored slides to be used in future educational pasture meetings.

A Year-round Pasture Calendar containing full details for year-round grazing has been developed to aid farmers in this program for the year 1947-48.

Summary, Observations, and Recommendations: All 30 cooperators decided to increase their acreages for 1947 planting. Plans were completed for year-round grazing for at least 20 of these cooperators. Seeding was done August 15 to September 1 of this year with some seeded in early August. All minerals were cut under before seeding, if available. Nitrate was cut under. Cultipacker was a must to preserve moisture, and stands of crimson clover seeded early. Oats, rye, grass, and crimson clover in combination furnished more grazing and produced a sod that was firmer in wet weather than any other combination. All livestock like well mineralized grazing. The Madison County Red Rust Proof and Nortex oats furnished more grazing and winter-killed probably less than upright growing oats.

Grazing and small grain programs fit well into the livestock and machinery farming. The farmers state that they have planned farther ahead in this program than ever before. A better conservation job has been accomplished with broadcast grazing crops on lands during heavy rainfall season. A better quality livestock with larger numbers used has resulted from the grazing. No mention of figures was made with the farmers regarding the general health of the livestock, but the veterinary bills and other losses were less than the average of neighbors who did not have fall and winter grazing, according to the local veterinarian.

This program has stimulated interest and is already responsible for several Grade-A dairy barns and beef herds. A better fencing and managing job is being accomplished in order to provide and control grazing and keep out neighbors' stock.

Due principally to this program, a larger per cent of PMA money was used in 1946-47 than the previous year, which meant more conservation practices completed. Farmers and businessmen have shown more interest and done more about this program than any program I have worked with since I have been in Pontotoc County. These farmers with this program are decreasing their cotton acreages voluntarily.

The cost figure averaged approximately $25 an acre, but in practically every case, the cost was grazed out by January 1. This cost included a 3- to 4-year supply of minerals which means that if the farmer saved his own seed, which he did in most cases, his only cost this fall was nitrate, breaking, and seeding.

The average of grazing days in 1946-47 was about 60. We hope to increase this to 120 days by planting a month earlier, increasing the grazing 4 to 5 times as much an acre by using 64 pounds nitrogen under grazing; seeding 4 bushels of the best grazing variety of oats to develop a sod that will stand more tramping; using a cultipacker in order to hold moisture, to get and hold a better stand of crimson clover, and pack the soil to prevent erosion; and by fencing to control grazing on various plots.

There seemed to be greater competition between small grains and legumes in the flatwoods and coastal plains areas than other areas, although different rates of minerals and nitrates influenced differences in other areas. Best results with crimson clover were obtained on Pontotoc Ridge soils, al-

though crimson did well in all areas. Rye grass, crimson clover, and wild winter peas did not furnish much fall and early winter grazing due to late plantings and growth habits. Combinations are being tried with promising results on wild winter peas and Johnson grass, wild winter peas and kudzu, wild winter peas and sudan, rye grass and wild winter peas, crimson and white Dutch clover and lespedeza with controlled grazing. Combinations that will reseed themselves to furnish year-round grazing have a definite place in the program.

This program seems to be one that will grow fast in Pontotoc County and in Mississippi.

Some Things to Think About

(*From page* 26)

thereto, one of the most impressive happenings during World War II was the very great increase in the consumption of fertilizer and liming materials. Thus fertilizer sales jumped from 8 million to 16 million tons and those of liming materials from 16 to 29 million tons in less than a decade. If the yearly tonnages of these soil-building agents were placed in 30-ton freight cars they would make a continuous train extending three times the distance between New York and San Francisco. Such a phenomenal increase in the consumption of soil amendments, much of which was due to their expanded use in areas to the west of us, indicates that the newer land is now beginning to show serious strain from continued crop removal. The growing of higher-yielding hybrid corn, greatly increased acreages of soybeans, and year-after-year wheat crops has exhausted the soil of such a large part of its native fertility that yields can no longer be maintained at the desired levels without assistance.

The important point for the Eastern farmer to remember in this connection is that the agriculture of this region has been able to meet the competition of the fertile lands of the West while they were still fertile. In proportion as Western farmers find it necessary to increase their expenditures for soil conservation and soil amendments the competitive position of the Eastern farmer is improved. In other words, the farmers of this area should be able to withstand an agricultural depression much better than those of the corn- and wheat-growing areas to the west of us.

In proportion as surpluses develop and the agricultural situation deteriorates, more and more loose talk will be heard to the effect that the federal government should subsidize the manufacture of fertilizers so that all farmers can afford to use them in liberal amounts. If this were done on the scale suggested by its advocates, the net effect would be to substitute fertilizer for soil conservation. Much of the free fertilizer would merely float off the plowed land with the topsoil to be carried down to spread over and cover up the already rich soil in the valleys. If the federal government wants to subsidize agriculture, it should operate in conjunction with the Soil Conservation Service to the end that loss of topsoil and waste of water are stopped.

One of the most troublesome problems that confronts the farmers of the Northeastern States is the deterioration of the physical properties of cultivated land. The channels that were left behind by the roots of the original forest trees which once covered this area have been clogged with soil. The substitution of tractors for horses has made it possible to have a larger percentage of the land under the plow. The size, weight, and number of farming implements are being increased. Tractors and other heavy machinery are being run over the land too early in the

spring and too soon after rains. As a result of all these, ponded areas and plow pans have developed, cutting down the capacity of the soil to absorb water, stopping the downward development of roots, and making crops more susceptible to drouth.

Now that crop surpluses are a possibility that cannot be ignored, it might be well to consider ways and means of taking some of the cropped land out of cultivation and renovating it. Greater effort should be put into the growing of deep-rooted hay and pasture legumes that send their taproots down deep into the subsoil to reopen it to the movement of air and water. Deep plowing, or the use of subsoiling devices, accompanied by the deep placement of lime, superphosphate, and potash, will aid in getting better stands of these legumes. Gypsum may be found to be of special value in this connection.

Thinking in terms of war and peace, bad and good weather, scarcity and surplus of food and feed, depression and prosperity, and disease and health, the best long-time move we can make is to encourage, by every means at our disposal, an increased consumption of meat, eggs, and milk, special emphasis being placed on the eggs and milk. Greater effort should be directed toward the development of grassland and forest agriculture. These offer tremendous possibilities in terms of more fertile soil, improved human health, better adjustment as between abundance and scarcity, and greater stability, not only for the agriculture of this country but for the whole economy of the Nation.

How Different Plant Nutrients Influence Plant Growth

(*From page* 9)

companion for phosphates; it combines with phosphates so that the latter can be moved to their proper places in the plant. We owe the beauty of a green world of vegetation to magnesium. It is the key element in the molecule of chlorophyll, the green pigment in plants that traps energy from the sun and makes plant life possible.

Plants develop a characteristic chlorosis when the magnesium supply is insufficient. One of the first deficiency diseases noticed was sand drown of tobacco. This is definitely a magnesium deficiency and generally occurs on the sandy coastal plain soils. Magnesium is usually added to the soil in the form of dolomitic limestone.

Iron

Plants need very little iron, yet it is a most essential element. It is directly connected with functioning of the chlorophyll. A lack of iron, therefore, will cause chlorosis in plants. In acid soils the iron is usually available to all plants, but in some neutral or alkaline soils it is so insoluble that some plants have difficulty in absorbing enough. In poorly drained soils iron may exist in a form that is toxic to plants, that is, when it is in the ferrous state. There are many cases of nutritional anemia among cattle and even among human beings directly traceable to soils deficient in iron. Plants grown on iron-deficient soils do not contain enough iron to support animals in health.

Manganese

In many soils and plants, manganese is a limiting element. A lack of manganese is usually associated with calcareous or overlimed soils. The recognition that manganese is an essential element for normal plant development has been confirmed by numerous investigators in the past few years. The gray speck of oats has been attributed to a shortage of this element in some soils. It has been found possible to cure the chlorosis of tomatoes and produce a normal growth on calcareous

Fig. 5. A spinach plant suffering from boron starvation. Note the numerous small, deformed leaves. The petioles were roughened, crooked, and twisted. These symptoms closely resemble the leaf symptoms on sugar beets.

soils of Florida by application of manganese.

Boron

A lack of sufficient boron is most likely to be associated with calcareous or heavily limed soils. When it is lacking, the plant is just as handicapped in performing its normal function as when it is starving for any one of the better recognized elements. A deficiency or excess of boron will produce characteristic symptoms in plants. In the past 15 years the effect of boron has been extensively studied. A number of heretofore puzzling diseases were found to respond to boron treatment. It has recently been shown that internal cork of apples, top rot of tobacco, cracked stem of celery, heart rot of sugar beets, and similar physiological diseases of plants are due to a deficiency of boron.

Copper

No upland soils that are low in organic matter have been found lacking in sufficient copper for plants. The need for copper is associated with soils of high organic content.

Zinc

Zinc has been found to be effective in treating some physiological diseases but not much is known about its action in plants

Fluorine

Fluorine has attracted considerable attention in recent years, not because of its influence on plant growth, but because of its value in the prevention of dental caries.

Iodine

It is known that when soils of an area lack iodine, the people living in that area do not receive enough in their locally grown food and, therefore, suffer a high incidence of goiter. A standard practice now is to add iodine to common table salt to furnish this element in the diet. Only in a few cases has the addition of iodine to the soil resulted in an increased crop yield.

There are many other elements found in plant tissue but there is controversy as to their actual value to the plant. From early days many soil investigators have centered their attention on nitrogen, phosphorus, and potassium and on methods of determining the so-called availability of these elements. Soil fertility is often defined in terms of these elements. However, the crop-producing power of soil involves far more than nitrogen, phosphorus, and potassium. The idea that these three elements are the only elements that are likely to be deficient has been thoroughly discredited.

It is evident that in the future more attention must be paid to soil deficiencies of all elements essential for normal development of plants and animals. The lack of accurate information on the content of secondary elements in the soil and plants and the effect of small quantities of these elements on animal and human health constitutes an important problem for further research.

Food Furore

(*From page* 5)

in cereal culture and utilization that the modern world has ever seen. It was a sweaty spell for the ones who guessed at the corn crop, and a turmoil for those who had to interpret its effect on domestic and foreign situations. We never had so many "situations" to shoot at in all our born days, nor as many fellows and gals with publicity machine-guns coming our way for powder and shot. Each crop report release day at 3 p. m. Eastern Standard Time saw mobs of the best magazine and big-town newspaper talent pushing and elbowing along the corridors of the Department to grab the hefty reports fresh from the figure foundry.

All that evening and part of next day the phones were jangling in jig-time. With maybe two or three perspiring purveyors of the Truth answering these calls and often relaying the worst questions to the adroit experts for solution, it was one joyous and entrancing bedlam. I suppose headline yarns and star radio vocalizers using much of this material served to spread the panic to far-off places.

Probably the real effect will not be as gruesome as some of the spread-eagle stories indicated. Reporters work in grooves and often find it hard to hit a proper balance. They take a cut phrase or a slogan for their cue, play up everything real and imaginary so it fits into the main theme, and work that until some fresh scent is met on the trail—when away they go like a pack after the new angle.

If the Information Desk dodges or parries or suggests some new approach, or tries to hint that we have had as bad situations and as poor corn crops as this one before and lived through it somehow, their comeback is that we may have had all this and Heaven too, but we did not have to share so much with foreigners.

Believe us, friends, Information people in a specialized agency like food must learn to be diplomats. On the one side we have the Bosses to protect and remain aware of lest the wrong inference be taken abroad. On the other and more pressing side, we are faced with a competitive press and radio, who expect and usually get a frank and fair analysis of what's commonly known as "background material." The trouble is, too much of the background gets into the foreground.

Moreover, your work as an Information person associated with farms and foods is not over when the last late release is phoned to the guy who had an assignment elsewhere than his customary "beat" with your agency. In any vast business circle such as this country has erected on the foundation of crops and livestock, you're bound to have a host of folks representing specialized and trade groups.

NEARLY a dozen requests arrive on an average routine day from members of the "laity," the ones not directly concerned with reporting for publication or radio. Maybe it's the meat packers wanting weekly figures on slaughter, or fats and oils exporters asking for latest allocations. Quite often some newcomer wants detailed reports on exports or imports, or some other data, which we do not handle. You shoo him away with kindly voice to pester some other government bureau.

The net, long-time result of all this surge of curiosity about farms and foods should provide a more general education to the masses relative to the hunger that is ours and the larder which is not replenished without much toil and some trouble. I wonder sometimes if this is really going to be the outcome. Or will there still remain some resentment, some feeling that farmers are grasping monopolists, that they rejoice

in the need to use an extension ladder to reach the grocery shelf.

I wish farmers didn't always seem to be on a sort of defensive and apologetic level. In hard times folks think farmers are grumblers and grouchers. At such periods their organizations are keyed defensively to the realities of low incomes on farms and social injustice. Then when we hit a better spell of higher rural wealth, we've got to explain, over and over, that farm income is not as tall as it looks after you subtract the expense "deducks." If an Information piece from a food agency fails to do this, it earns the audible chastisement from the farmers which it probably deserves.

Once again, with your indulgence, let's fumble into the fact bin and come forth with some alleged authoritative digits:

We begin by reminding everyone great and small that Mr. Farmer is also a Consumer. Too many reporters and editors in cities forget that. They think he picks all his food off the bushes and the bullocks probably.

Anyhow, we start with the fact that in late summer the farmer went to his food store and paid $1.95 for what cost him one dollar in the 1935-39 interval. Farmers buy a whale of a lot more stuff at the store to put into their pantries than your columnist tells you about. The above $1.95, remember, is just the same price the city man paid when *he* went buying meats and groceries.

NOW let's see what kind of a rubber dollar the farmer had to stretch in some other ways. He dug out his wallet and handed over $3.40 to his hired man for every dollar he paid him in 1935-39. Now on the same ratio we find the bloated income of the farmer tapped in a few other useful directions by the same old law of supply and demand that makes a nickel look like counterfeit money to urbanites.

For seed of a verified and quality kind he pays $2.40 to the old dollar; for building material, $2.20 to the dollar; for mixed feed, $2.65; and for somewhat less advanced items of cost, like machinery and fertilizer, he pays possibly around $1.36. But he's going to use more of the things he can get in ample supply, such as machinery and fertilizer, and if he didn't use them the consumer would think himself back in the starvation era again.

NOT all the background material for the support and explanation of current spot news in agriculture and food matters comes from the ones who are in the immediate breach, facing the daily volleys of high pressure queries. Tucked away in quiet office rooms in a cloistered, almost an academic fashion, are a few writers who have time to ponder. Some of them devote their lives to analyses of past and proposed economic trends and public policies. The lunch hour spent with these savants is quite refreshing, in that it proves to a hurry-up worldling that ponderous, uncontrollable, almost elemental, forces are at work constantly behind the fret and blather of every hectic day.

The other group of studious gentry is engaged in prying loose the secrets and processes within the network of scientific research bureaus—both State and National. They are popular interpreters of the jargon of the laboratory. They have their troubles no end, and also their victories and triumphs. We of the daily release department merely stamp the suitable release date on their productions, after such go through the tedious but necessary grill of "clearance." Some of them make front page position too, especially if they bear some news significance.

Now to some folks it would appear that a chap who spends so much of his waking hours hurling facts and figures broadcast to inquisitive newshawks is soon due for a couple of ulcers and a perpetual headache. On the contrary, many of us in the thick of the furore really take to it like a farmer takes to

harvests. If you don't carry all of it home with you or dream about it at night, if you balance your momental urgency with a dash of philosophy and see this whole thing as a process that began long before you were able to count and will keep on being an emergency long after you have been counted out, your nerves will stand the strain, even without fluid foods to sustain you.

Of course, not all the information agencies linked to food are found in the Government bureaus. The States also have their well-oiled offices to handle this with emphasis on localized aspects. Then there are a host of associations and food-handling outfits that use trained writers and observers to make contact with the public.

TAKING it broadly, I would much prefer to be a food information writer than one assigned to boost the virtues and the thrills of entertainment, athletics, cosmetics, soap, styles in clothing, or luxury lines. You'd get a lot of advantages in some ways that the food zealots seldom get. They might make you presents of the commodities you purvey in the event of some great successful outcome, whereas food informers never get a sack of spuds or a barrel of cider sent in compliments for their zeal. But aside from those rewards of a mundane sort, all the advantage seems to lie with the food informers.

It also lies with the ones who write copy for the agencies that serve farmers, because such facts quickly turn into net profit and eventually more tonnages of victuals. More production is wanted in the hungry world, and the best way to get it is to make it easier and more attractive for people to train for and engage in agriculture. That and the improvement of the farmer's public relations are of momentous significance, and will continue to be for the rest of the century—unless we decide to kill off the excess population rather than to give them a decent grubstake.

Time Proven LaMotte Soil Testing Apparatus

LaMotte Soil Testing Service is the direct result of 26 years of extensive cooperative research with agronomists and expert soil technologists to provide simplified soil testing methods. These methods are based on fundamentally sound chemical reactions adapted to the study of soils, and have proved to be invaluable aids in diagnosing deficiencies in plant food constituents. These methods are flexible and are capable of application to all types of soil with proper interpretation to compensate for any special soil conditions encountered.

Methods for the following are available in single units or in combination sets:

Ammonia Nitrogen	Iron
Nitrate Nitrogen	pH (acidity & alkalinity)
Nitrite Nitrogen	
Available Potash	Manganese
Available Phosphorus	Magnesium
Chlorides	Aluminum
Sulfates	Replaceable Calcium

Tests for Organic Matter and Nutrient Solutions (hydroculture) furnished only as separate units.

LaMotte Outfit For Determining Available Potash

This unit designed for accurately measuring the amount of replaceable potash in the soil. A test can be made in five minutes, and it is very simple to perform. Result easily determined by a unique reading device which was developed in our own laboratory. Complete with instructions, price $15.00 f.o.b., Towson.

Information on LaMotte Soil Testing Equipment sent upon request.

LaMotte Chemical Products Co.

Dept. BC Towson 4, Md.

Father: "Didn't I hear the clock strike three when you got in last night?"

Daughter: "Yes, daddy. It was going to strike eleven but I stopped it so it wouldn't waken you."

* * *

"So," sobbed Nadya Oblomvivitch, "Ivan Skarenski is dead. Do you say he spoke my name as he lay dying?"

"Part of it," replied the friend, "part of it."

* * *

Serious young man—"Do you enjoy Kipling?"

Flapper—"I don't know—how do you kipple?"

* * *

WITHOUT A DOUBT

A clergyman, at a dinner, had listened to a talkative young man who had much to say on Darwin and his "Origin of the Species."

"I can't see," he argued, "what difference it would make to me if my grandfather was an ape."

"No," commented the clergyman, "I can't see that it would. But it must have made a great difference to your grandmother."

* * *

"All right back there?" called the conductor from the front of the car.

"Hold on!" came a feminine voice. "Wait till I get my clothes on."

The entire carful turned and craned their necks expectantly. A girl got on with a basket of laundry.

Cleo—"Dere goes dat slatternly Mandy Johnson wid her ten pickininnies. She sho' do look repugnant."

Mozelle—"Lan' sakes, agin?"

* * *

FAIR WARNING

Two of the girls were airing their troubles. "I'd like to get a divorce," said the first. "My husband and I just don't get along."

"Why don't you sue him for incompatibility?" asked the second, sympathetically.

"I would if I could catch him at it," replied the first.

* * *

"Have you said your prayers, Willie?"

"Yes, mom."

"Did you ask to be made a better boy?"

"Yes. And I also put in a good word for you and dad."

* * *

Right after the visitor left, Grandma, who had been seriously ill, seemed to take a decided turn for the better. When her daughter came into the room, the old lady asked, "What did you say was the name of that new minister?"

"That wasn't the new minister who called on you, Grandma. That was the doctor—the specialist we called from the city."

"You don't say," said Grandma, "Well, now that you mention it, I did think he was a mite too familiar for a minister."

Need for—

BORON IN AGRICULTURE

Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.

Outstanding results have been obtained with the application of Borax in specific quantities or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.

The work of the State Agricultural Stations and recommendations of the County Agents are steadily increasing the recognition of the need for Boron in agriculture. We are prepared to render every practical assistance.

Borax is economical and very little is required. It is conveniently packed in 100 lb. sacks and stocks are available for prompt delivery everywhere in the United States and Canada. Address your inquiries to the nearest office.

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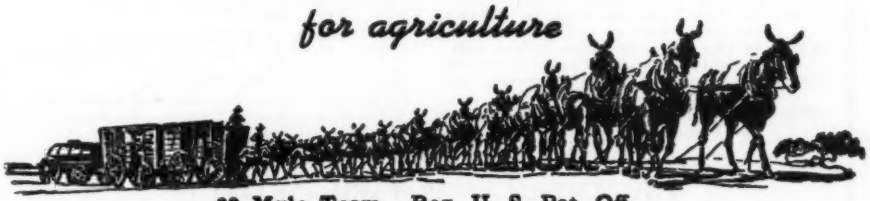
BORAX

for agriculture



20 Mule Team. Reg. U. S. Pat. Off.

AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

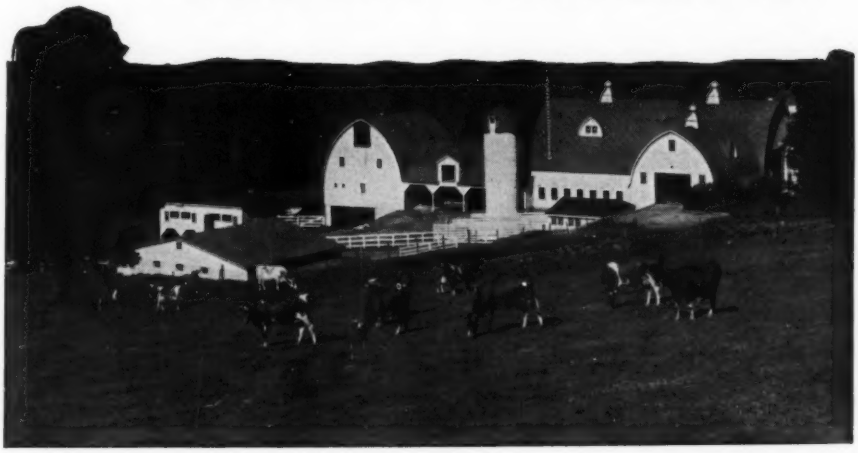
Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

Reprints

N-9 Problems of Feeding Cigarleaf Tobacco
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
II-12-42 Wartime Contribution of the American Potash Industry
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
A-1-44 What's in That Fertilizer Bag?
H-2-44 Efficient Fertilizers for Potato Farms
AA-8-44 Florida Knows How to Fertilize Citrus
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—the Aristocrat
DD-5-45 A Case of Combined Potassium and Boron Deficiencies in Grapes
GG-6-45 Know Your Soil
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
TT-10-45 Kudzu Responds to Potash
ZZ-11-45 First Things First in Soil Fertility
CCC-12-45 Poor Soils—Poor People
B-1-46 Potash Increases Tomato Yield and Quality
H-2-46 Plow-sole Placed Plant Food for Better Crop Production
N-3-46 Sweet Potatoes Are Proving New Gold for the South
S-4-46 Plow-under Fertilizer Ups Corn Yields
T-4-46 Potash Losses on the Dairy Farm
W-4-46 Muck Soils Produce Quality Sweet Corn for Canning
Y-5-46 Learn Hunger Signs of Crops
AA-5-46 Efficient Fertilizers Needed for Profit in Cotton
BB-5-46 The Soil Is Our Heritage
HH-6-46 Mistakes Versus Essentials of Pond Management for Fish
II-6-46 Pastures in Mississippi Produce Profits
LL-8-46 Trends in the Use of Major Plant Foods
NN-10-46 Soil Testing—A Practical Aid to the Grower & Industry
OO-10-46 Soil Aeration Affects Fertilizer Needs
VV-11-46 Using Potash in Soil Conservation
WW-11-46 Soil Requirements for Red Clover
XX-12-46 Farm Mechanization in Relation to Cotton Quality and Marketing
YY-12-46 How Guernsey Calves Helped Solve a Feed & Crop Fertilization Problem
ZZ-12-46 Alfalfa—A Crop to Utilize the South's Resources
BBB-12-46 Fertilizing & Cropping Systems for Flue-Cured Tobacco
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
B-1-47 The Use of Dipicrylamine in Tissue Testing for Potash
C-1-47 Potash Meets Its Responsibilities
D-1-47 Good Pastures Conserve and Pay
G-2-47 Research Points the Way for Higher Corn Yields in North Carolina
H-2-47 Large Grasses for Pasture
I-2-47 Fertilizers and Human Health
J-2-47 Yields Tell the Story
K-2-47 Potash Pays for Peas at Chehalis, Washington
L-3-47 Sugar Beets Require Adequate Soil Aeration
M-3-47 The Role of Major Elements in Plant Nutrition
N-3-47 Efficient Management for Abundant Pastures
O-3-47 Increased Quality of Products Is Answer to the Problem
P-3-47 Year-round Grazing
Q-4-47 Fertilizers for Sugar Beets
R-4-47 The Effects of Fertilizers on the Blackland Soils of Texas
S-4-47 Rice Nutrition in Relation to Stem Rot of Rice
T-4-47 Fertilizer Practices for Profitable Tobacco
V-4-47 Don't Feed Alfalfa at the "Second Table"
W-4-47 The Search for Nutrient Deficiencies in Farm Crops
X-5-47 Potato-growing Developments in New England
Y-5-47 Increasing Grain Production in Mississippi
Z-5-47 Building and Maintaining Good Lawns
AA-5-47 The Potassium Content of Farm Crops
BB-5-47 More Palatable Grass Is More Nutritious
CC-5-47 Ten Years of Soil-building in Vermont
DD-6-47 Profitable Soybean Yields in North Carolina
EE-6-47 The Wheelocks of Vermont Grow Grass
FF-6-47 Community Cooperation in Soil Conservation
GG-6-47 Corrective Measures for the Salinity Problem in Southwestern Soils
HH-6-47 Determining New and Better Fertilizer Ratios
II-8-47 Whole-farm Demonstrations
JJ-8-47 Analyzing the Soils of Northwest Louisiana
KK-8-47 Minor Plant Nutrients
LL-8-47 Reshaping New England Farm Land
MM-8-47 Fertilizing Potatoes Economically in Aroostook County, Maine

THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. WASHINGTON 6, D. C.

PASTURES are CASH CROPS



PASTURES can be made the most profitable land on the livestock farm. Well-managed and properly-fertilized pastures often yield four to five times as much succulent, green, nutritious forage as the same land would yield without fertilizer and good management.

Early and liberal application of pasture fertilizer helps grasses and legumes to make quick, vigorous growth, rich in proteins, minerals, vitamins and other nutrients. Grazing this high-quality, appetizing, green forage, dairy cows increase milk production and meat animals rapidly put on valuable weight.

The abundant use of fertilizer on pastures not only yields more and better grazing, it also furnishes many extra grazing days—spring, summer and fall. By producing extra yields of low-cost, high-quality green feed which animals can harvest, pasture fertilizer saves labor and greatly reduces expensive barn feeding. And the good ground cover of grasses and legumes protects the soil from erosion.

Virginia-Carolina Chemical Corporation has been a leader in the manufacture of better pasture fertilizers, for many years. There is a V-C Fertilizer for every crop on every soil on every farm.

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VC FERTILIZERS

Make the good earth better!

THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

OTHER 16MM. COLOR FILMS AVAILABLE FOR TERRITORIES INDICATED

Potash in Southern Agriculture (South)
In the Clover (Northeast)
Bringing Citrus Quality to Market (West)
Machine Placement of Fertilizer (West)
Ladino Clover Pastures (West)
Potash from Soil to Plant (West)
Potash Deficiency in Grapes and Prunes (West)
New Soils from Old (Midwest)
Potash Production in America (All)
Save That Soil (All)
Borax From Desert to Farm (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

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